Arab Republic of Egypt
Ministry of Education
Book Sector

Science

Think and learn

2nd prep.
second term

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2015-2016

غير مصرح بتداول هذا الكتاب خارج وزارة التربية والتعليم

المقدمة

عزيزى التلميذ / التلميذة : .....

يسعدنا أن نقدم هذا الكتاب لأبنائنا تلاميذ الصف الثانى الإعدادى، ونؤكد على أن تعلم العلوم عملية نشطة وممتعة ومثيرة للتفكير فى تنفيذ الأنشطة العملية، وتصميم النماذج والأشكال والجداول، وكتابة التقارير والبحوث البسيطة، والتقصى والتحقق من البيانات والمعلومات، وطرح الأسئلة والتأمل والتواصل، والقيام ببناء التفسيرات عن المفاهيم والظواهر الطبيعية، وتطبيق المعرفة فى المواقف الحياتية، وحل المشكلات من خلال التخطيط والتجريب والتعلم التعاونى، وهذه الإجراءات والمهارات هى التى يتناولها تعلم العلوم القائم على الاستقصاء والتعلم النشط، واستخدام مهارة التفكير العلمى والابتكارى أو الإبداعى والنقد والتأمل.

وقد تم اختيار عنوان لهذا الكتاب يعكس فلسفته، وهو فكِّر وتعلَّم، وقد تم الاسترشاد فى إعداده بآراء بعض المتخصصين فى المناهج وطرق تدريس العلوم والموجهين والمعلمين والتلاميذ، تأكيدًا لفلسفة الكتاب وأسس بنائه وتطويره، وتم تحديد فلسفة الكتاب فى ضوء المعايير القومية للتعليم وللتربية العلمية.

ويهدف هذا الكتاب إلى مساعدة التلاميذ على إدراك العلاقة بين العلم والتكنولوچيا، وفهم تاريخ وطبيعة العلم، وتنمية مهارات التفكير والمهارات الحياتية، والفهم العلمى السليم للمفاهيم الأساسية، وتنمية الاتجاهات العلمية والقيم الاجتماعية لتحقيق التربية العلمية للمواطنة وللحياة وللعمل، من خلال إثارة تفكير التلاميذ، والاستفادة من مراكز ومصادر التعلم داخل المدرسة وخارجها، بالإضافة إلى توظيف استراتيچيات التعلم النشط والتعلم البنائى.

ولتحقيق هذه الأهداف تم استخدام مداخل متنوعة فى شكل وحدات وموضوعات دراسية مترابطة ومتكاملة مع بعضها ومع المواد الدراسية الأخرى.

ويتناول كتاب الفصل الدراسى الثانى ثلاث وحدات، هى :

- الحركة الدورية
- الصوت والضوء
- التكاثر واستمرارية النوع

ونحن إذ نقدم هذا الكتاب نرجو الله أن يحقق الفائدة منه.

والله ولى التوفيق،،،

المؤلفان

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Unit One Assessment

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Unit Three Assessment

Second Term Assessment

Unit 1

Periodic Motion

Lessons of the Unit

Lesson 1 : Oscillatory Motion.

Lesson 2 : Wave Motion.

Resources of knowledge and learning

- **Books and scientific encyclopedia**

1. Simple Scientific Experiments (Physics) — Saphere
2. Power and Motion – Steve Parker — Dar El-farouk
3. Everything about Science — Lebanon Lib. Publishers
4. The encyclopedia of simple science (Nanotechnology) — Saphere

Learning objectives of the unit

By the end of studying this unit, the student should be able to:

1. Recognize the concept of the oscillatory motion.
2. Use the materials and tools precisely to define the concept of the oscillatory motion.
3. Conclude the properties of the oscillatory motion.
4. Conclude the relation between the periodic time and the number of complete oscillations.
5. Recognize the relation between the frequency of the vibrating body and the number of complete oscillations.
6. Appreciate the contribution of the scientist Hertz in the study of the oscillatory motion.
7. Appreciate the contribution of the scientist Higgins in designing the pendulum clock.
8. Recognize the role of the wave in transferring energy.
9. Recognize the concept of wave motion.
10. Use the materials and tools precisely to conclude the concept of wave motion.
11. Use the materials and tools precisely to compare between transverse and longitudinal waves.
12. Classify waves according to their direction of propagation.
13. Classify waves according to the ability to propagate and energy transfer in space.
14. Compare between transverse and longitudinal waves.
15. Recognize the properties of wave motion.
16. Recognize the relation used to determine the wave velocity.
17. Conclude the relation between the frequency of the wave and its periodic time.
18. Conclude the law of wave propagation.
19. Compare between oscillatory motion and wave motion.
20. Protect the ears against the hazards of noise pollution.

Lesson 1

Oscillatory Motion

Lesson objectives :

By the end of studying this lesson, the student should be able to:

1. Recognize the concept of the oscillatory motion.
2. Use the materials and tools precisely to determine the concept of the oscillatory motion.
3. Conclude the properties of the oscillatory motion.
4. Define the amplitude of an oscillation.
5. Conclude the relation between the periodic time and the number of complete oscillations.
6. Recognize the relation between the frequency of a body and the number of complete oscillations in a single second.
7. Appreciate the contribution of scientists in recognizing the oscillatory motion.

Elements of the lesson :

1. The concept of oscillatory motion.
2. Graphical representation of the oscillatory motion.
3. Some concepts related to the oscillatory motion and its properties.

Involved Issues:

The effect of science and technology on society.

You have studied before the motion of bodies and you may know the two kinds of motion.

- What are they? .....
- What is meant by periodic motion? .....

Examples of periodic motion:

- Oscillatory motion.
- Wave motion.

The concept of oscillatory motion:

- Have you noticed the movement of a swing Fig. (1)? It goes forwards and backwards around its point of rest or position of equilibrium.
  This type of motion is known as oscillatory motion.
  You can participate with your classmates to perform the following activity.

Motion of swing
Fig. (1)

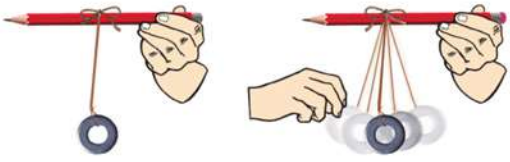
Activity (1) Defining the concept of oscillatory motion.

Materials and tools :

- a pencil.
- a 30 cm. long thread.
- a quarter pound coin.

Steps :

1. Setup a simple pendulum by winding one of the thread ends at the middle of the pencil, while the other end is attached to the coin (the oscillating body)
2. Grab the pencil with your left hand, and pull the coin to the right. Then, let it go Fig. (2)



Oscillatory Motion
Fig. (2)

Observation :

1. What do you observe regarding the motion of the oscillating body (The coin)?
   .....
2. What is the relation between the values of displacement of the oscillating body on either side of the equilibrium position in every oscillation?
   .....
3. At which position the velocity of the oscillating body becomes maximum ? And when it reaches the minimum value?
   .....

Conclusion :

1. The periodic motion made by the oscillating body around its point of rest, where the motion is repeated through equal intervals of time, is known as the oscillatory motion.
2. The velocity of the oscillating body reaches its maximum value when it passes the point of rest, and it decreases gradually as the body moves away.

Enrichment information (1)

* Examples of oscillatory motion:
  - The movement of the Earth's crust during earthquakes.
  - The movement of atoms in molecules.

Wonder

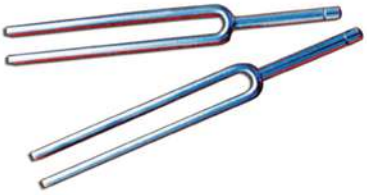
Have you asked yourself about the relation between the velocity of the pendulum and its kinetic energy?

Communication

Discuss with your classmates – under the supervision of your teacher – the relation between the increase in the velocity of the pendulum and its kinetic energy.

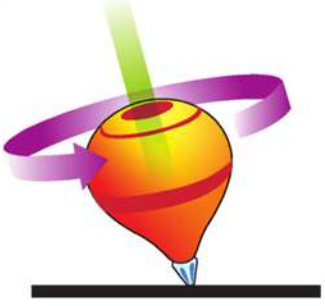
Exercise (1)

Put (✓) below the figure that represents an example for oscillatory motion:



Tuning fork
Fig. (3)

Stretched string
Fig. (4)



Rotary bee
Fig. (5)

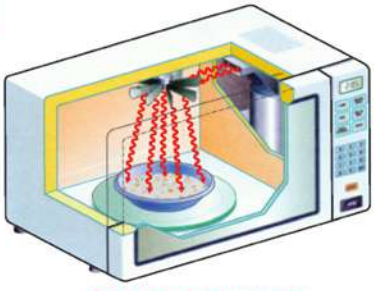
Real life application | The Microwave oven

The idea behind the operation of the microwave oven Fig. (6) is that microwaves make water molecules present inside the cooked food vibrate.

This forces the molecules to collide with each other. That produces a lot of heat energy that helps cooking the food faster.

The pots to be used inside the microwave oven should be made of pottery, ceramics or glass.

Never put metal cooking pots or vessels inside a microwave oven, as metals do reflect microwaves back to the source.



Microwave oven
Fig. (6)

Activity (2) Graphical representation of oscillatory motion.

You can participate with your classmates to do the following activity.

Materials and tools :

- Smooth paper tape winding around two rolls.
- Spring.
- Weight.
- Nail.
- Pencil.

Steps :

1. Attach the pencil to the weight and hang the weight at one end of the spring.
2. Hang the other end of the spring using the nail after having it fixed to the wall, in a way that makes the pencil tip touch the paper roll exactly in the middle.
3. Pull the spring downwards then let it go.

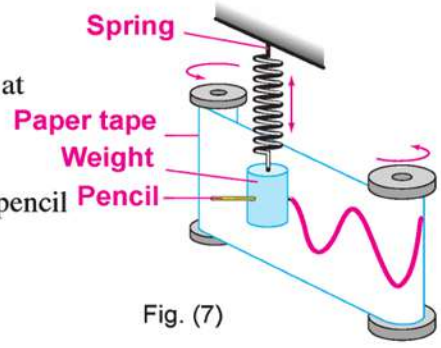


Fig. (7)

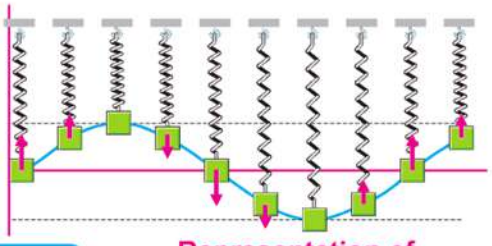
Don't forget to wind the paper roll regularly.

What is the shape formed on the paper roll?

.....

- Oscillatory motion is represented as shown in Fig. (8).

The simple harmonic motion is considered the simplest form of oscillatory motion.


Representation of oscillatory motion (Simple Harmonic Motion)
Fig. (8)

Concepts related to Oscillatory Motion

Properties of oscillatory motion are expressed in terms of many concepts, like:

1 Amplitude :

Observe the motion of the pendulum Fig. (9):

It makes maximum displacement when it reaches:

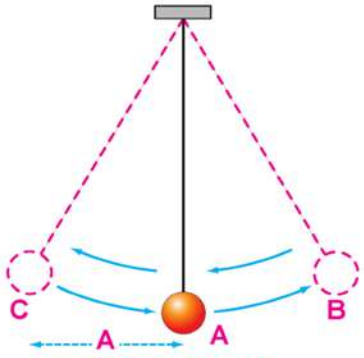
- the point (B) on the right side.
- the point (C) on the left side.

What is the relation between the values of displacements (AB) and (BA)?

.....

What is the relation between the values of displacements (AB) and (AC)?

.....



Oscillation of pendulum
Fig. (9)

The maximum displacement achieved by an oscillating body away from its point of rest is called the amplitude and is measured in meter (m).

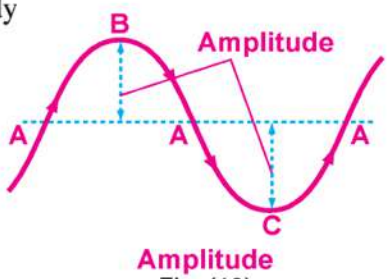


Fig. (10)

2 Complete oscillation:

When the ball of the pendulum moves form (B) to (A) to (C) then back to (A) and finally to (B), the pendulum is said to have completed one oscillation. This complete oscillation can be expressed as follows:

B→A→C→A→B

Then, the same cycle is repeated starting from (B).

The complete oscillation is known as the movement made by the oscillating body when it passes a single point in its path of motion, two consecutive times in the same direction Fig. (11).

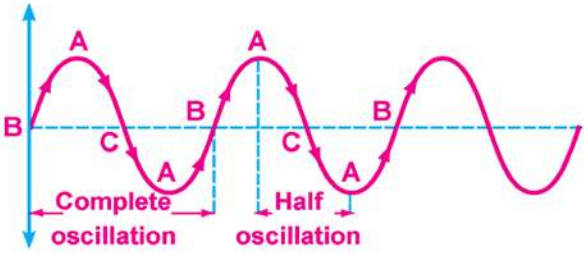


Fig. (11)

• How many amplitudes does a complete oscillation comprise in Fig. (11)?

.....

Exercise (2)

In Fig. (12)

1. In which graph, the amplitude is larger?

   .....

2. How many complete oscillations do exist between the points x and y represented on both graphs?

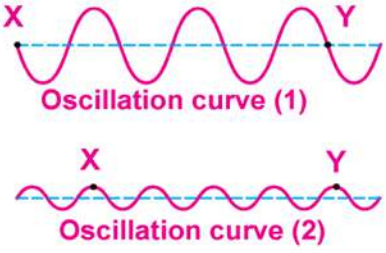


Fig. (12)

3 Periodic Time (T)

The time needed by an oscillating body to make a complete oscillation is known as the periodic time. It is denoted by (T).

Periodic time is measured in seconds (s), and can be determined by the following relation:

$$\text{Periodic time (T)} = \frac{\text{Time (seconds)}}{\text{Number of complete oscillations}} \quad \text{..... (1)}$$

Exercise (3)

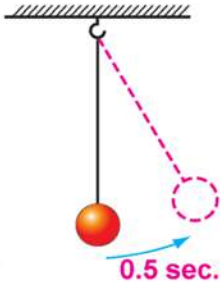


Fig. (13)

What is the periodic time for the pendulum oscillating in Fig. (13)?

.....

4 Frequency (F)

When a simple pendulum makes 50 complete oscillations in 10 seconds;
-How many complete oscillations the pendulum makes in 1 second, which is known as *the frequency*

.....

- What is the periodic time for the pendulum?

$$T = \frac{\text{.....}}{\text{.....}} = \frac{\text{.....}}{\text{.....}} = \text{.....} \text{ seconds}$$

From all of the above, we can see that frequency is the reciprocal of periodic time. This implies that frequency can be determined by the relation;

$$\text{Frequency (F)} = \frac{\text{Number of complete oscillations}}{\text{Time (seconds)}} = \text{.....} \quad (2)$$

From the relations (1) and (2) we can conclude that:
frequency x periodic time = 1

What kind of mathematical relationship does the Fig. (14) represent?

.....

Frequency is measured in Hertz (Hz), after the German scientist Hertz.
Multiplies of the Hertz:
Kilohertz = 1 x 10^3 Hertz
Megahertz = 1 x 10^6 Hertz
Gigahertz = 1 x 10^9 Hertz

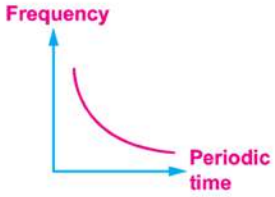


Fig. (14)

Exercise (4)

Calculate the periodic time and frequency for an oscillating body that makes 300 complete oscillations in half a minute.

Time = ... × ..... = ...seconds

$$T = \frac{\text{.....}}{\text{.....}} = \frac{\text{.....}}{\text{.....}} = \text{.....} \text{ seconds}$$

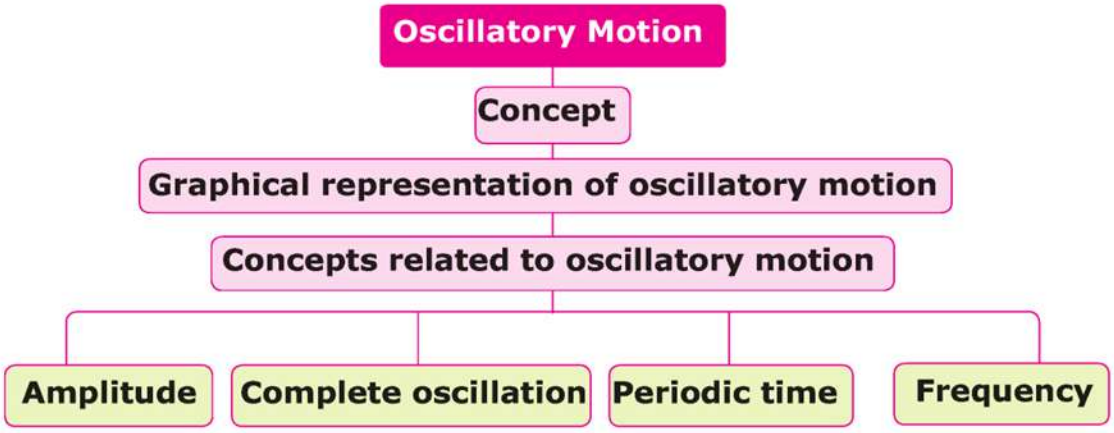
$$F = \frac{\text{.....}}{\text{.....}} = \frac{\text{.....}}{\text{.....}} = \text{.....} \text{ Hertz}$$

A case for discussion | **Discussion Point: Team Work**

- While a group was performing an experiment to determine the frequency of a pendulum, the calculations and results appeared to be slightly different. Accordingly, the personal opinions of the members get different.
  Discuss with your classmates, under the supervision of your teacher, this issue and make the following questions or enquiries part of your discussion:

  - Is recording more than one result for the same activity considered a principle of good work? And why?
  - Do you prefer to agree with the nearest result to the correct result or you prefer your classmate's results?
  - Do you think that the differences in calculations and results or in personal opinions can lead to personal conflicts? or appreciation of the thoughts of others?
  - What are the advantages and disadvantages of both team and individual work?

Lesson summary



- Examples of periodic motion; oscillatory motion and wave motion.
- A complete oscillation comprises 4 amplitudes.
- Frequency of an oscillating body equals the reciprocal of its periodic time.

Lesson One Assessment

1 Write the scientific term for each of the following statements:

(a) The periodic motion made a body around its point of rest, where the motion is repeated through equal intervals of time. (……)

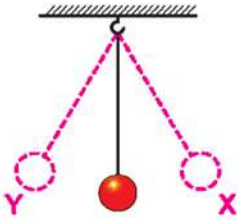
(b) The number of complete oscillations produced by the oscillating body in one second. (……)

2 Choose the right answer from those between brackets, mention the reason for you choice:

(a) The result of multiplying the frequency of an oscillating body by its periodic time equals……

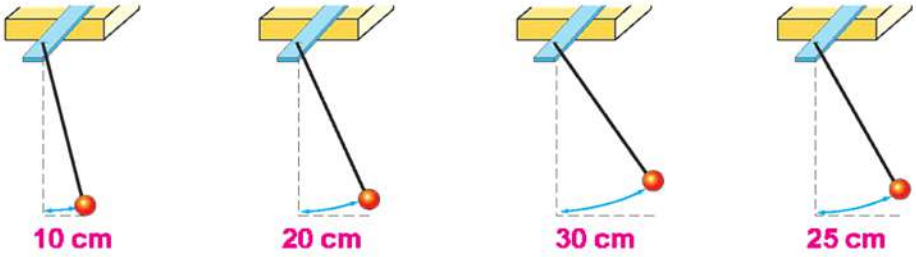
($\frac{1}{2}$ – $\frac{1}{4}$ – $\frac{1}{3}$ – 1)

(b) In the opposite figure; when the ball of the pendulum moves from (x) to (y) in a duration of 0.02 seconds, the frequency equals……..Hertz



(0.04 – 0.02 – 25 – 50)

(c) The following figures describe the oscillation of a simple pendulum of amplitude = ……



(30 cm – 25 cm – 20 cm – 10 cm)

3 What is meant by…?

(a) The number of complete oscillations made by an oscillating body in duration of 10 seconds is 500 complete oscillations.

……..

(b) The time taken by a spring to make 60 complete oscillations is 1 minute.

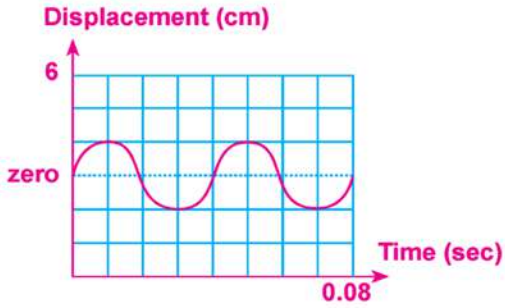
……..

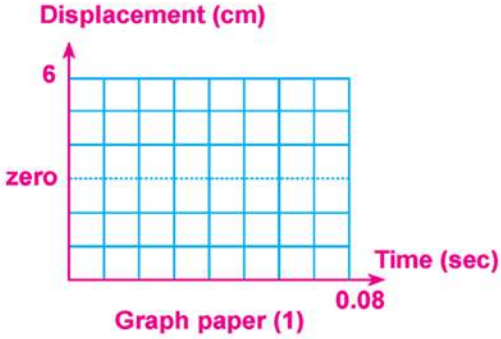
4 The opposite figure represents the motion of an oscillating body. Using the figure;

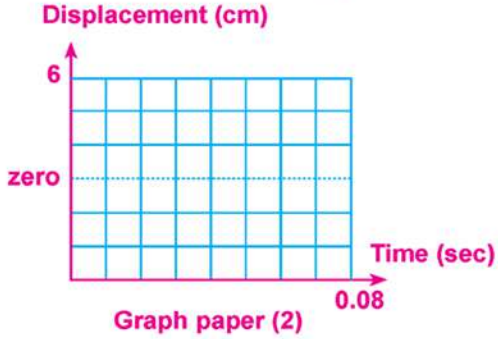
(a) Find the periodic time of the oscillating body.

(b) Redraw the figure in graph paper 1, showing double of the frequency and the same amplitude.

(c) Redraw the figure in graph paper 2, showing the same frequency and double of the amplitude.







5 Creative Thinking

x, y and z are three examples of oscillatory motion (motion of the pendulum, motion of the spring and the motion of a string) out of order.

If (x) doesn't represent the motion of the pendulum or the spring and (y) doesn't represent the motion of the pendulum, analyze these data to find out which symbol represents each motion.

.....

.....

Activity

- Imagine that you were a pendulum hanging from a tree branch. Write down a short story, not more than 10 lines, describing your motion.
- Take into consideration the concepts related to the oscillatory motion should be used.

Lesson 2

Wave motion

Lesson objectives

By the end of studying this lesson, the student should be able to:

1. Recognize the concept of a wave.
2. Recognize the role of the wave in transferring energy.
3. Recognize the concept of wave motion.
4. Use the materials and tools precisely to conclude the concept of the wave.
5. Classify waves according to direction of propagation.
6. Use the materials and tools precisely to compare between transverse and longitudinal waves.
7. Classify waves according to their ability to propagate and transfer energy in space.
8. Compare between transverse and longitudinal waves.
9. Recognize the properties of wave motion.
10. Recognize the concept of wave length.
11. Recognize the relation used to determine the velocity of the wave.
12. Conclude the relation between the frequency of the wave and its periodic time.
13. Conclude the law of wave propagation.
14. Compare between oscillatory and wave motions.
15. Protect the ears against hazards of noise pollution.

Elements of the lesson :

1. Defining a wave and its role in transferring energy.
2. The concept of wave motion.
3. Transverse and longitudinal waves.
4. Mechanical and electromagnetic waves.
5. Some concepts related to wave motion and its properties.
6. Law of wave propagation.

Involved Issues:

The effect of science and technology on society.

- Notice what is formed on the surface of still water when some water drops fall on that surface.
  The propagation of concentric circles on the surface of water represents a wave motion.

Fig. (1)

The role of waves in energy transfer:

To be familiar with the role of waves in transferring energy, you firstly need to be familiar with the wave concept.

Activity (1) Defining the concept of wave and its role in energy transfer.

Place some pieces of dominos in the form of a line as shown in Fig. (2). Make sure that the pieces are placed at equal distances from each other.

Fig. (2)

What happens when you push the first domino piece down?

……..……..

Do the pieces change position after falling?

……..……..

Explanation:

When the first domino piece falls, its energy would transfer to the next one. That falls down in turn, transferring the energy to the next piece and so on.
Energy transfer through the domino pieces continues and the pieces never change position in the line.

Conclusion:

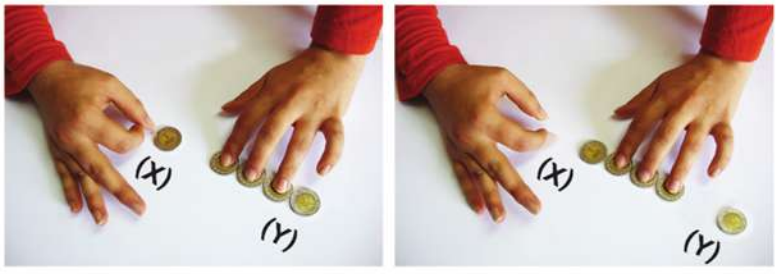
The disturbance that propagates and transfers energy in the direction of propagation is known as a wave.

Exercise (1)

How do you explain the motion of the coin (x) when the coin (y) is pushed, though they never touch?

……

……



(A) (B)

Fig. (3)

The concept of wave motion:

To recognize the concept of wave motion, you can take part with your classmates in doing the following activity.

Activity (2) Concluding the concept of wave motion.

Materials and tools :

- hollow tube 30 cm long.
- a burning scent stick.
- a candle.
- a tuning fork.

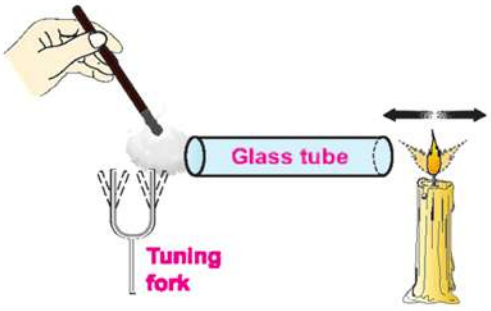


Fig. (4)

Steps :

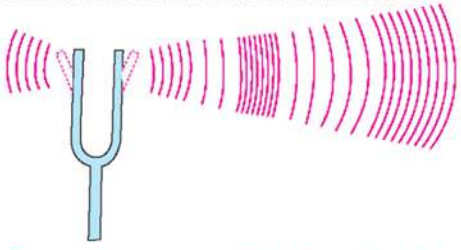
1. Place the tube horizontally and place the candle at one of its ends and the scent stick at the other end.
2. Hit the tuning fork and place it near the scent stick.

Observations :

1. What happens to the flame of the candle?
   .....
2. What are the waves that have transferred the energy from the tuning fork to the candle flame? .....
3. Do air particles move with the movement of sound waves through the tube? How could you prove this?
   .....

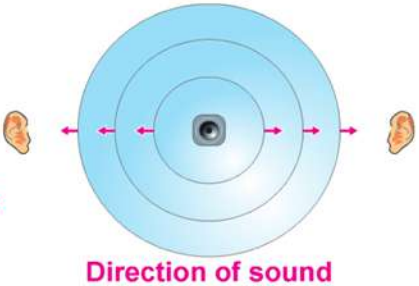
Explanation :

1. When the tuning fork vibrates, the produced energy is transferred in the form of sound waves.
2. The particles of the medium (air and smoke particles) do not move form their original places during transferring sound waves carrying energy to the candle flame.


Sound waves emitted by a tuning fork
Fig. (5)

Conclusion :

The movement resulting from the vibration of the medium particles at a certain moment in a specific direction is known as a wave motion.
The direction of progression of the wave is known as the line of wave propagation.



Direction of sound wave propagation
Fig. (6)

Types of waves

- Waves are classified according to the direction of vibration of medium particles relative to the direction of propagation, into:

• Transverse waves. • Longitudinal waves.

Waves are also classified according to the ability to propagate and transfer energy, into:

• Mechanical waves. • Electromagnetic waves.

Transverse and longitudinal waves:

To compare between transverse and longitudinal waves, take part with your classmates in performing the following activity.

Activity (3) Comparison between transverse and longitudinal waves.

Materials and tools :

• Spring. • Colored tape. • Nail.

Steps :

Fig. (7)

1. Fix one end of the spring to a wall using the nail.
2. Tie the colored tape at the middle of the spring.

Observations :

1. Describe the direction of wave propagation (rings of the spring coil), and the direction of vibration of the medium particles (the colored tape), in:

• The first case
when moving the spring coil up and down or to the right and left, perpendicular to the axis of the spring coil. Fig. (8)

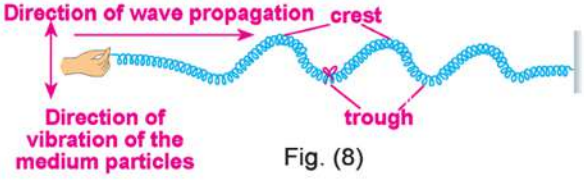


Fig. (8)

• The second case
when pushing and pulling the coil rings at the free end. Fig. (9)

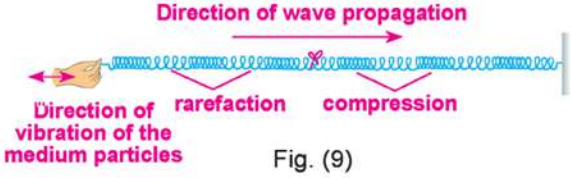


Fig. (9)

2. Does the position of the rings change during wave propagation in any of the above cases?

3. In which case:

- The rings go up and down forming crests and troughs consecutively? .....
- The rings get near and far from each other forming compressions and rarefactions consecutively? .....

Conclusion :

1. The disturbance which causes the particles of the medium to vibrate perpendicular to the direction of wave propagation is known as the transverse wave Fig. (10), while the disturbance that causes the particles of the medium to vibrate along the direction of wave propagation is known as the longitudinal wave Fig. (11).

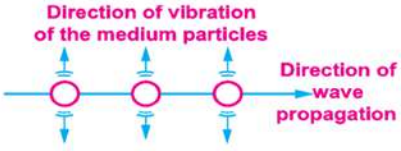


Fig. (10)

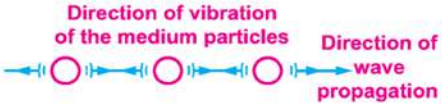


Fig. (11)

2. During wave propagation, the particles of the medium do not change position; however they vibrate around their point of rest.

3. The transverse wave is formed of crests and troughs as compared to the longitudinal waves which are formed of compressions and rarefactions Fig. (12).

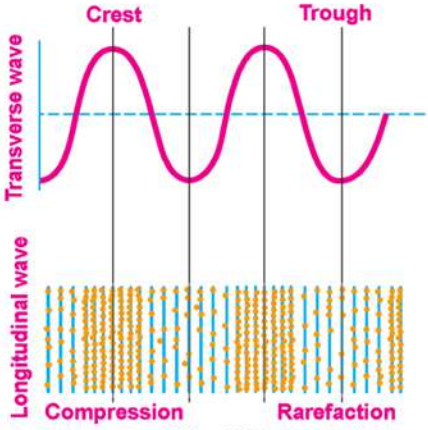


Fig. (12)

4. The highest point in a transverse wave with respect to the horizontal is called the crest, while the lowest point is called the trough.

5. In longitudinal waves, the point of highest density and pressure is called compression, while the point of lowest density and pressure is called rarefaction.

Exercise (2)

Compare between transverse and longitudinal waves:

Point of comparison	Transverse wave	Longitudinal wave
Definition	.....	.....
	.....	.....
Composition	.....	.....
	.....	.....

Real life application | Physiotherapy tubs (Jacuzzi)

In most health clubs you can find these tubs known as Jacuzzi. Jacuzzi is a tub where water moves in the form of circular waves. It's used to treat sprains and cramps when used with hot water and nervous tension when used with cold water.

Fig. (13)

Ask yourself:

Have asked yourself, why you can't hear the sound of solar explosions while you can see the light coming out of it?

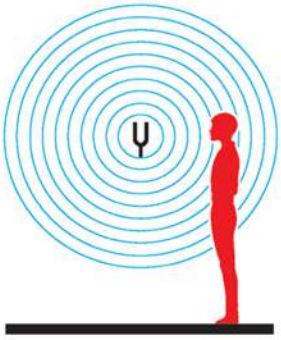
Communication

Discuss with your classmates under the supervision of your teacher, the reason behind hearing thunder after seeing lightening though they both do happen at the same time?

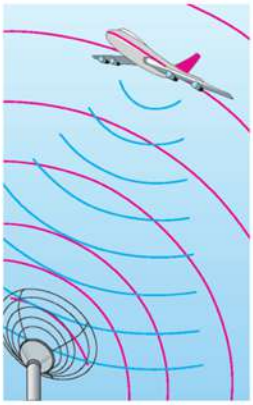
Mechanical and electromagnetic waves:

- Some waves need a materialistic medium in order to propagate. These waves are known as mechanical waves, like transverse water waves and longitudinal sound waves.

Water waves
Fig. (14)



Sound waves
Fig. (15)



Radio waves
Fig. (16)

Other waves do not need the presence of any medium to propagate through as they can propagate through space. These waves are known as electromagnetic waves, like light waves and radio waves used in radars and they are all transverse waves.

- Both mechanical and electromagnetic waves propagate in different materialistic media with various velocities. However the velocity of mechanical waves is much slower than that of electromagnetic waves. Electromagnetic waves have the advantage of propagating in space with a velocity of 3×10^8 m/s.

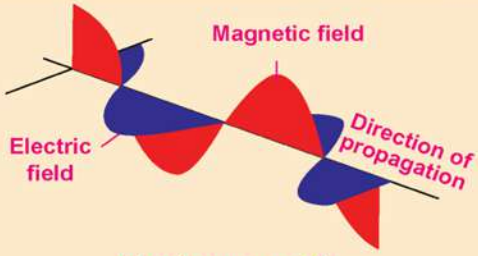
Exercise (3)

Compare between mechanical and electromagnetic waves.

.....

Enrichment information and activity (1)

- Electromagnetic waves are considered as transverse waves that can propagate in space as they are formed of an electric field and a magnetic field perpendicular to each other and to the direction of wave propagation, as well.
- Write a report about electromagnetic spectrum and add it to your portfolio.



Electromagnetic
Fig. (17)

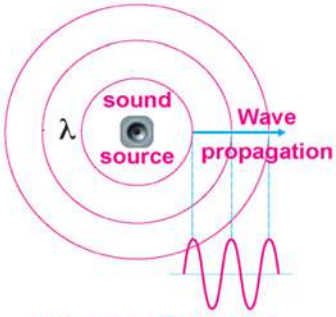
Concepts related to wave motion:

Oscillatory motion is similar to wave motion whether transverse or longitudinal as each can be represented as shown in the Fig. (18)

They are also similar according to some properties.

The following are some concepts that can express the properties of wave motion:

- Wavelength.
- Wave velocity.
- Amplitude.
- Frequency.



Representation of longitudinal wave
Fig. (18)

1 Wavelength (λ):

The distance between the centers of two consecutive compressions or rarefactions is known as the wavelength.

Can you conclude the definition of the wavelength of a transverse wave from Fig. (19)?

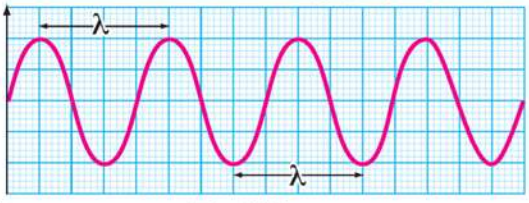


Fig. (19)

.....

Wavelength can be expressed by the symbol (λ).

The measuring unit is the meter (m) or fractions of a meter;

Millimeter (mm) = 1×10^{-3} meter

Micrometer = 1×10^{-6} meter

Nanometer = 1×10^{-9} meter

Enrichment information (2)

* The following table shows the wavelengths for some electromagnetic waves:

Visible light	380 : 700 Nanometer
Infrared rays	10^3 : 10^6 Nanometer
Microwave	10^6 : 10^9 Nanometer

2 Amplitude:

It is the maximum displacement achieved by the particles of the medium away from their points of rest.

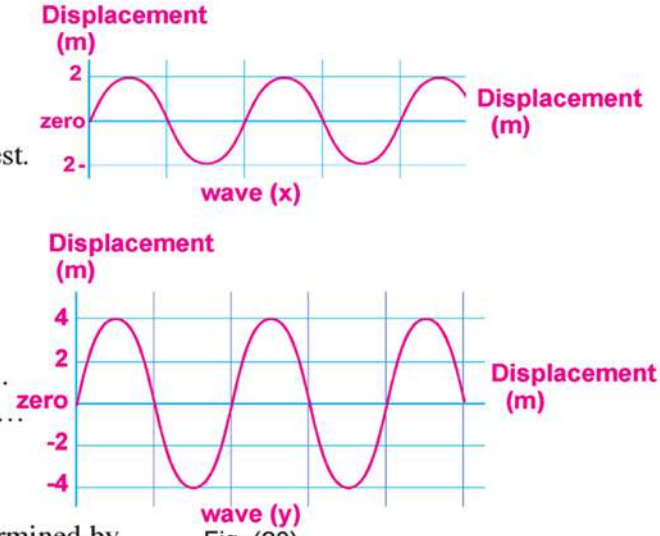


Fig. (20)

Exercise (4)

Compare between the amplitude of both waves (x) and (y) shown in Fig. (20)

.....

.....

3 Wave velocity (v)

If the velocity of a wave can be determined by the relation

$$\text{Velocity (V)} = \frac{\text{Distance covered by the wave in meters (m)}}{\text{Time in seconds (s)}}$$

The measuring unit is meter per second (m/s)

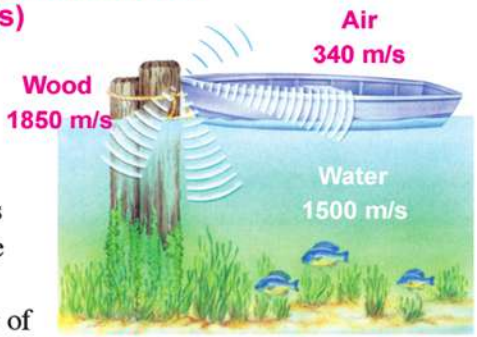
Can you conclude a definition for wave velocity?

.....

.....

The velocity of a given wave is constant as it travels through the same medium. However, it differs as the nature of the medium changes Fig (21).

Wave velocity represents the velocity of the transfer of the energy carried by the wave.



Different sound speeds in different media
Fig. (21)

4 Frequency (F):

Regarding you have recognized the definition of frequency for an oscillating body, can you define the frequency of a wave?

.....

What is the relation between the frequency of a wave (F) and its periodic time (T)?

.....

Enrichment information (3)

- The high destructive tidal waves known as Tsunami have a wavelength reaching 200 km and an amplitude of 30 meters with a velocity reaching 800 km/hour.
- Collect pictures and photos from magazines and wibsites, besides some stories told by residents of areas that were subject to the hazards of such waves, and add them to your portfolio.

Enrichment information (4)

- A glass cup is shattered when its natural frequency is equivalent with the frequency of a nearby sound source, as the amplitude of the oscillation of the cup particles becomes too large.
- This phenomenon is known as resonance.

Fig. (22)

The law of wave propagation:

The law of wave propagation explains the relation between the wave velocity (v), its frequency (F) and wavelength (λ).

Wave velocity (v) = frequency (F) x wavelength (λ)

This relation is known as the law of wave propagation and it can be applied to all kinds of waves. Fig (23).

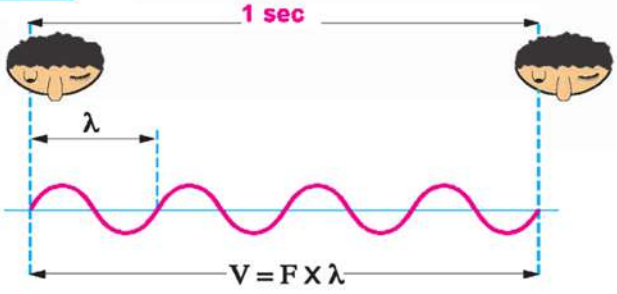


Fig. (23)

Exercise (5)

Calculate the wavelength in meter for a visible light wave of frequency 6×10^{14} Hertz and velocity 3×10^{8} m/s.

Wavelength = ……÷…… = 3×10^{8} ÷ …… = ……meter.

Can you compare between the oscillatory motion and the wave motion?

Oscillatory motion	Wave motion
……	……
……	……
……	……

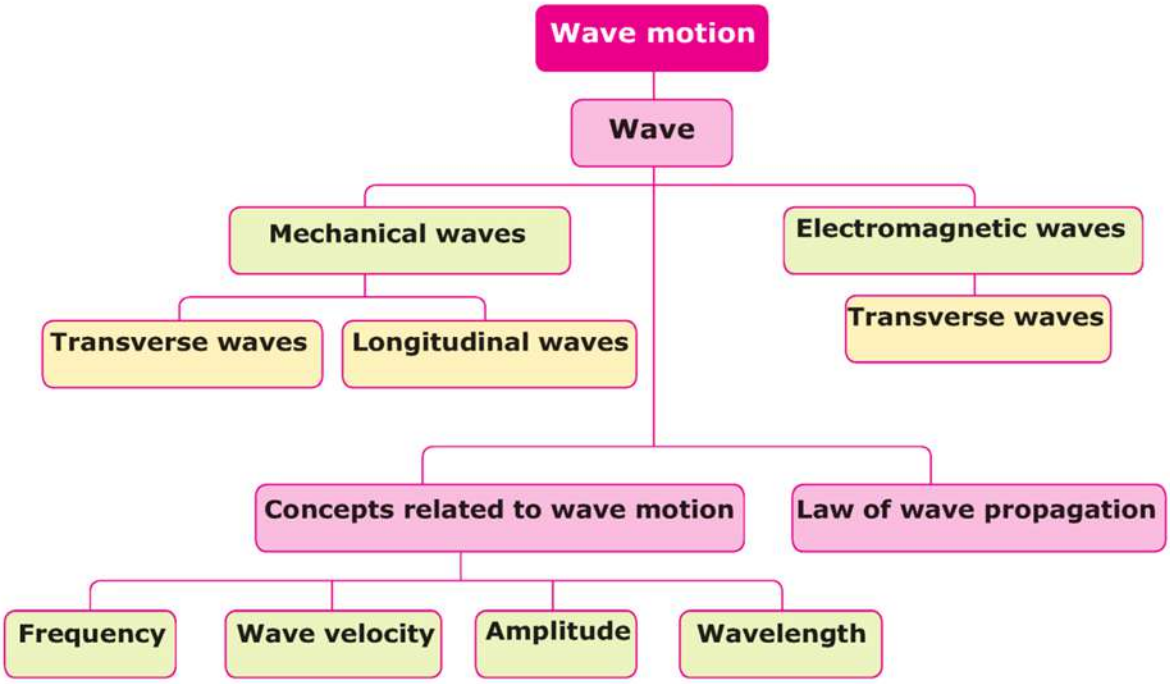
Discussion issue **Electromagnetic Pollution**

Some telecom companies offer deals to real-estate owners in order to setup amplification towers on the roofs of their buildings, in return of a huge some of money. On the other hand, the residents of such houses or buildings reject such deals as the electromagnetic waves coming out of these towers are very harmful to health.

Discuss this issue with your classmates under the supervision of your teacher, taking into consideration the following inquiries:

- What will be your decision if you were one of those owners, and you were offered such kind of deals?
- What will be your reaction as one of the residents, if this deal was done and the tower is already set to work?
- Are you sure about the hazards of such towers? What are you resources regarding such hazards?
- What do you think about the advantages and disadvantages of cell phones?

Lesson summary



- Wave motion is the motion produced as a result of the vibration of the particles of the medium in a certain point and in a certain direction.
- The longitudinal waves are formed of compressions and rarefactions, while transverse waves are formed of crests and troughs.

Lesson Two Assessment

1 Complete the following statements:

(a) Waves are classified according to the ability to propagate and transfer energy into..... and .....waves.

(b) The crest in.....wave is equivalent to .....in longitudinal wave.

(c) Radio waves are considered.....waves that propagate in space with a velocity of.....

2 Correct the following statements without changing the underlined parts:

(a) Transverse wave is a disturbance that causes the particles of the medium vibrate in the same direction of wave propagation.

.....

(b) The movement of the clock pendulum is an example for wave motion.

.....

(c) A body of frequency 200 Hertz makes a complete oscillation in 200 seconds.

.....

3 What is meant by...?

(a) The wavelength of a sound wave is 30 cm.

.....

(b) The distance covered by a visible light wave in space in two seconds equals 6×10^8 meter.

.....

4 Compare between each of the following:

(a) Longitudinal waves and transverse waves.

.....

.....

(b) Oscillatory motion and wave motion.

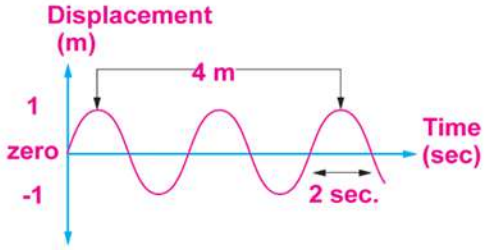
.....

.....

5 From the opposite figure, find;

(a) Wavelength. (b) Frequency.

(c) Amplitude. (d) Wave velocity.



6 Sound waves of frequency 200 Hertz and wavelength in air 1.7 meter.
Calculate:

(a) The velocity of sound wave propagation in air.

.....

(b) The wavelength of these waves when they propagate in water with velocity 1500 m/s.

.....

7 Creative Thinking:

Write down ten different scientific terms, where every term consists of two words, one of them is «wave».

.....

.....

Activity

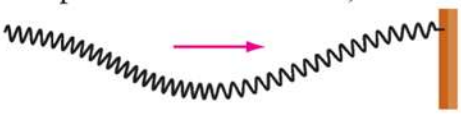
Use an old wire coil, like that of telephones, in setting up a panel that represents transverse and longitudinal waves, using the wax gun to fix the wire to the panel.

Unit One Assessment

1 Choose the right answer from those between brackets:

(a) If the distance between the center of the third compression and the center of the fifth compression on the wave propagation is 20 cm,
Then, the wavelength of this wave is……
(40 cm – 20 cm – 10 cm – 5 cm)

(b) In the opposite figure; the particles of the medium (the coil) vibrate;……..
(to the right only – upwards only – to right and left – upwards and downwards)



(c) If the frequency of an oscillating body was 6 Hz, then the periodic time is……..seconds.
(6 – 3 – 1/3 – 1/6)

2 Cross the odd word out. Then, state the relation among the remaining words:

(a) Sound wave – light wave – radio wave – infrared wave
…….

(b) Pendulum motion – spring motion – rotary bee motion – stretched string motion
…….

3 Give reasons for each of the following:

(a) Oscillatory motion is considered as a periodic motion.
…….

(b) The waves due to vibration of strings are mechanical transverse waves.
…….

(c) We see lightening before hearing thunder.
……..

4 What are the results of .....?

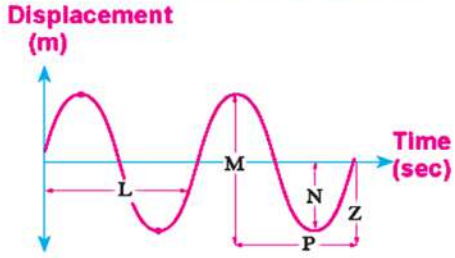
(a) The vibration of the particles of a medium in a direction normal (perpendicular) to the direction of wave propagation?

.....

(b) The increase in the frequency of a wave to double its value with respect to the wavelength when the wave velocity is constant?

.....

5 The opposite figure represents an oscillatory motion for a simple pendulum. Choose the letter that denotes:



(a) The oscillation of the pendulum forming 3/4 complete oscillation. (....)

(b) The amplitude (.....)

Reflection and Self evaluation

Dear student, after studying unit one; periodic motion, state your opinion and point of view by answering the following questions:

(1) What are the topics you found useful after studying this unit?

.....

(2) What were the wrong ideas or thoughts you had about some concepts and scientific phenomena and have been corrected by studying this unit?

.....

(3) What are the difficulties you faced during studying this unit and performing the activities?

.....

(4) What are the topics you have studied and you need to revise its content to be able to understand it in a better way?

.....

(5) What are the topics, you suggest studying in this unit and they are not included?

.....

Unit 2

Sound and Light

Lessons of the Unit :

Lesson 1 : Properties of Sound Waves.
Lesson 2 : Reflection of Sound Waves.
Lesson 3 : Wave Nature of Light.
Lesson 4 : Reflection and Refraction of Light.

Sources of knowledge and learning :

- **Books and scientific encyclopedia**

1 Sound – Natalie M. Rosenisky	Family Library
2 Light – Natalie M. Rosenisky	Family Library
3 Sound – Steve Parker	Dar El-Farouk
4 Sound and Light	Lebanon Library Publishers
5 Questions and Answers Encyclopedia (Science and Technology)	Family Library

Learning objectives of the unit

By the end of studying this unit, the student should be able to:

1. Identify the wave nature of sound.
2. Conclude some properties of sound like; sound pitch, intensity and quality of sound.
3. Use materials and tools to illustrate the factors affecting the pitch and intensity of sound.
4. Conclude laws of reflection of sound.
5. Use materials and tools to prove the laws of sound reflection.
6. Describe some real life applications for echo.
7. Compare between sound waves according to their frequency.
8. Identify some real life applications for ultrasonic waves.
9. Appreciate the value of sound in our life.
10. Appreciate the importance of science and technology in sound.
11. Identify the wave nature of light.
12. Conclude the laws of reflection and refraction of light.
13. Describe some natural phenomena related to light reflection and refraction.
14. Appreciate the importance of light to human life and society.
15. Like to work with others in small co-operative groups.
16. Appreciate the value of co-operative and team work.
17. Appreciate the importance of science and technology in optics.
18. Recognize the interaction between science and technology and the society.
19. Become objective, honest and highly precise when carrying out scientific experiments.

Lesson 1

Properties of Sound Waves

Lesson objectives:

By the end of studying this lesson, the student should be able to:

1. Recognize the wave nature of sound.
2. Identify the concept of sound pitch.
3. Conclude the factors on which sound pitch depends.
4. Use materials and tools to demonstrate the concept of sound pitch.
5. Use Savart – wheels to determine tunes.
6. Identify the concept of sound intensity.
7. Conclude the factors on which sound intensity depends.
8. Define the inverse square law in sound.
9. Recognize the relation between sound intensity and the amplitude of the sound source.
10. Recognize the effect of wind direction on the intensity of sound travelling through it.
11. Use materials and tools to recognize the effect of amplitude on sound intensity.
12. Use materials and tools to recognize the effect of surface area of a vibrating surface on sound intensity.
13. Use materials and tools to recognize the effect of the medium density on sound intensity.
14. Compare between types of sound waves according to their frequency.
15. Identify some of real life applications for ultrasonic waves.
16. Appreciate the value of co-operative and team work.
17. Appreciate the value of science and technology in human life.
18. Appreciate the importance of sound in our life.
19. Appreciate the power of God as expressed in the creation of man.
20. Appreciate the blessing (grace) of hearing.

Elements of the lesson:

1. Wave nature of sound.
2. Properties of sound waves «sound pitch, sound intensity, sound quality».
3. Comparing sound waves according to frequency.

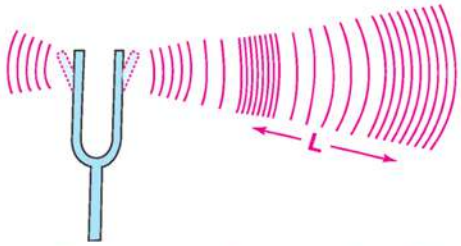
Involved Issues:

1. The role of science and technology in human life and society.
2. Noise and sound pollution.

What is sound? How is it produced?
What is the wave nature of sound?

The wave nature of sound.

You have already know that sound is an external stimulus that affects the ear and causes hearing.
It is produced by the vibration of the bodies Fig. (1) Sound stops as soon as the bodies stop vibrating. Sound waves are mechanical longitudinal waves that propagate in different media in the form of spheres, where the center of these spheres is the sound source itself.



Sound waves from a tuning fork
Fig. (1)

Sound travels in air at a velocity 340 m/s. It may exceed or become less than this value.
What do longitudinal sound waves consist of?
……..

Exercise (1)

What is meant by the wavelength of a sound wave is 1.5 meter?
……
Would you apply the law of wave propagation to sound waves when calculating their velocity of propagation?
……

Exercise (2)

Calculate the wavelength of a sound wave propagating in sea water with velocity 1500 m/s, knowing that the frequency of the wave is 10 kilo. Hertz.

F = 10 x …….. = …….Hertz.

v = ……x……..

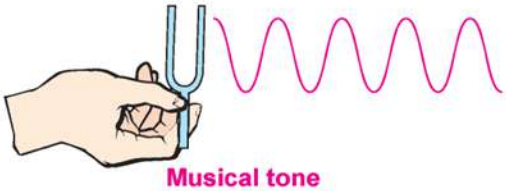
∴ λ = …….÷…… = …….÷…….. = …… meter

Enrichment information and activity (1)

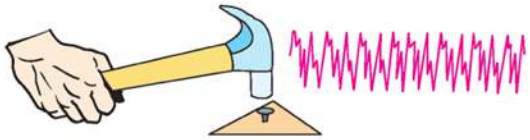
- Air temperature and humidity do affect the velocity of the propagating sound through air.
- What is the relation between sound velocity in air and humidity percentage?
- Does the change in atmospheric pressure affect sound velocity ?

Properties of Sound Waves:

What can we call sound produced by vibration of a tuning fork and that produced by hammering a nail?



Musical tone
Fig. (2)



Noise
Fig. (3)

- Sounds heard by the human ear are classified into two types:

1. Musical tones of uniform frequency and comfortable to be heard. Fig. (2)
2. Noise of non-uniform frequency and is uncomfortable to be heard. Fig. (3)

Exercise (3)

Mention (3) sound sources that can produce:

- Musical tones.....
.....
- Noise:.....
.....
.....

Violin
Fig. (4)

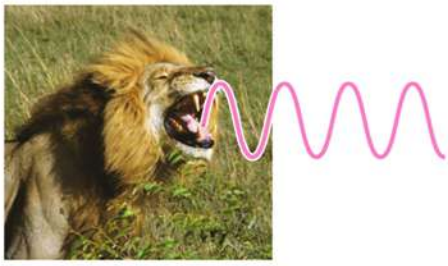
Drill
Fig. (5)

The ears can distinguish different sounds on the basis of three characteristics (factors); which are:

- Sound pitch.
- Sound intensity.
- Sound quality.

1 Sound Pitch:

- With your eyes shut down, can you distinguish between?
  - The voice of a lion and a sparrow.
  - Your mister's and mistress's voices.



Low pitched sound
Fig. (6)

High pitched sound
Fig. (7)

The voice of the lion is harsher than that of sparrow.
The voice of the mistress (woman) is sharper and softer than the voice of the mister.
As the sharpness of voice increases, the level of voice gets higher.
The level of the voice is expressed by what is known as the sound pitch.
This can be illustrated by the following activity that you can take part in with your classmates in the co-operative group:

Activity (1) Illustration of the concept of sound pitch.

Materials and tools :

- Big sized book.
- Rubber band.
- Two pens.

Fig. (8)

Steps :

1. Tie the rubber band around the book and insert the two pens below the band, closer to the book edges. (Fig 8).
2. Press on the band at a distance 10 cm from one of the two pens by the forefinger of the left hand.
   Then, pluck that segment by the forefinger of the right hand.
3. Repeat the above step several times changing the length of the vibrating segment each time.

Observations :

1. Does the sound pitch change as the length of the vibrating segment changes?
   .....
2. When does the sound become sharper? And when does it become harsher?
   .....
3. What is the relation between the length of the vibrating segment of the band and the number of vibrations taking place in one second?
   .....

Al-Ashraaf printing house

Conclusion :

1. Sound pitch is a property of sound by which the ear can distinguish between harsh and sharp voices.
2. Sound pitch depends on the frequency of the source, where the sharpness of sound increases as the frequency increases. On the other hand harshness of sound increases as the frequency decreases.

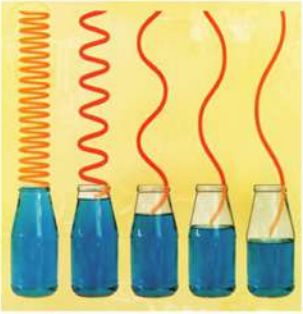


Fig. (9)

Exercise (4)

When blowing through bottles as illustrated in Fig. (9)
When can you hear a high pitched sound? And why?

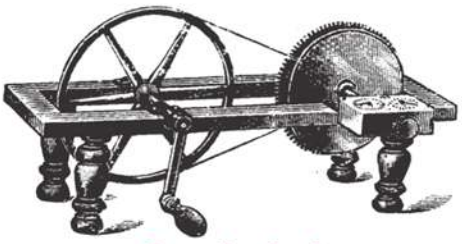
Enrichment information (1)

- The sound pitch of the siren of the car fire increases gradually as it approaches you and decreases suddenly as it moves away. That is due to the apparent change in the frequency of the produced sound. This phenomenon is known as Doppler's effect.

Fig. (10)

Determining the pitch of a tone using Savart's Wheel.

Savart's wheel is used to determine the pitch (frequency) of an unknown tone.
How can you perform that with your friends?



Savart's wheel
Fig. (11)

1. Listen to the tone you want to determine its pitch till your ears get used to it.
2. Start rotating savart's wheel at the same time one of the gear teeth will come in contact with a flexible metal sheet. Start increasing the speed of rotation till you hear a sound similar to that of the unknown tone.
3. Calculate the number of turns (cycles) (d) taking place in a specific duration (t) and by knowing the number of teeth of the gear (n), you can determine the frequency of the tone by the relation;

$$\text{Frequency (f)} = \frac{\text{Number of cycles (turns) (d)}}{\text{Time (t)}} \times \text{The number of the teeth (n)}$$

Exercise (5)

Calculate the frequency of a musical tone similar to the frequency of an emitted tone using Savart's Wheel rotated with a velocity of 960 cycles in two minutes, given that the number of teeth of the gear is 30 teeth.

t = 2 x ..... = ...seconds

$$f = \frac{d \times n}{t} = \frac{\ldots\ldots\ldots\ldots x \ldots\ldots\ldots\ldots}{\ldots\ldots\ldots\ldots} = \ldots\ldots\ldots\ldots\ldots\ldots Hz$$

2 Sound Intensity:

Assume that a play was performed in an open air theatre without using any sound amplifier Fig. (12).

Would you prefer to sit in the front rows or at the back ones? And why?

When the ear is close to the sound source, it will be affected more by the sound and vice versa.

This can be explained as follows; the sound intensity at a point is the amount of energy falling perpendicular to a unit area surrounding this point in one second.

Play in an open air theatre
Fig. (12)

Sound intensity is measured in Watt/meter^2

Sound intensity is known to be a sound characteristic by which the ears can distinguish strong and weak sounds.

Due to the wide range of sound intensities heard by humans and the variance in sensitivity to sound intensity from one person to another, scientists agreed to express the level of sound intensity or noise intensity by using Decibel scale.

Enrichment information (3)

- Shows the relation between sound intensity and noise intensity.
- Write down a research about sound sources and their relation to sound and noise intensity.
- Also show the relation between the above mentioned items and preventive health approaches regarding preservation of hearing sense.

Table. (1)

Sound source	Sound intensity (watt / m^2)	Sound intensity (decibel)
- Quiet sounds like whispering and ruslting trees.	1×10^{-12}	zero
- Loud sounds like the sound of a motorbike.	1×10^{-6}	60
- Deafening sounds like that of jet planes.	1×10^{3}	150

Factors affecting sound intensity:

- Sound intensity at a point depends on some factors, which are:
  - The distance between the sound source and the ear.
  - The amplitude of the sound source.
  - The area of the vibrating surface.
  - The density of the medium through which sound travels.
  - Direction of the wind.

1 The distance between the source of sound and the ear :

To identify the effect of the distance between the sound source and the ear on the intensity of sound, perform the following activity with your classmates:

Activity (2) **Identify the effect of the distance between the sound source and the ear on the sound intensity.**

Steps :

1. Stand in front of your mate who is supposed to make a sound of a certain tone.
2. Move away gradually from your mate…what do you notice?

.....

Fig. (13)

Conclusion :

Sound intensity decreases gradually as the distance between the sound source and the ear increases.

And it is proven that sound intensity at a point is inversely proportional to the square of the distance between the source of sound and that point.

This is known as the inverse square law.

2 The amplitude of the sound source :

To determine the effect of the amplitude of the sound source on the sound intensity, you can take part with your classmates in performing the following activity:

Activity (3) To identify the effect of the amplitude of the sound source on sound intensity:

Steps :

Fig. (14)

1. Fix one end of a ruler on the edge of a table by your right hand.
2. Pull the other end of the ruler by the other hand, and then set it free.

What do you observe regarding sound intensity arising from the vibration of the ruler?

.....

Explanation:

The amplitude of the sound source (the vibrating ruler) decreases by time.

Conclusion :

As the amplitude of vibration of the sound source decreases, the sound intensity gets weaker gradually.
Sound intensity is directly proportional to the square of the amplitude of vibration of the source.

Exercise (6)

Fig. (15) represents two sound waves. Compare between them regarding the pitch and intensity.

.....

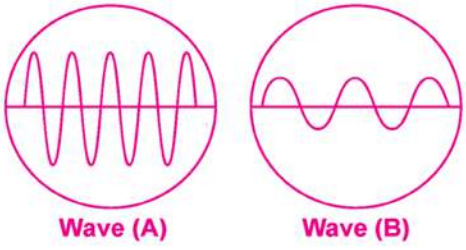


Fig. (15)

3 The area of the vibrating surface:

To identify the effect of the area of the vibrating surface on the produced sound intensity, take part with your classmates in the following activity:

Activity (4) Identify the effect of the area of the vibrating surface on the sound intensity:

1. Make a call to a cell phone adjusted to the vibration mode.
   This phone carried on the hand of your classmate. (Fig16)
2. Ask your partner to put the phone on an empty box, opened at one of its

Fig. (16)

sides to act as a resonance box.

3. Compare the sound intensity in both cases.

.....

Explanation:

The resonance box increases the area of the vibrating surface with the air inside.

Conclusion :

Sound intensity increases when the source of sound touches a resonance body (box) due to the increase of the surface area of the vibrating body.

4 The medium density :

To identify the effect of the medium density on sound intensity traveling through this medium, you can perform the following activity with your classmates.

Activity (5) To identify the effect of the medium density on sound intensity :

Materials and tools :

- Air vacuum pump.
- Glass jar.
- Sound source (Alarm clock)

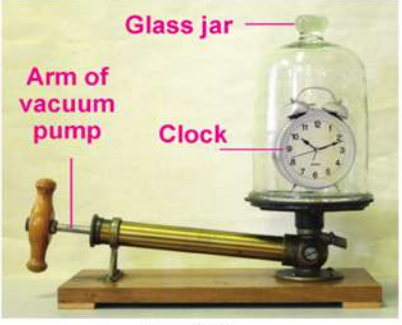


Fig. (17)

Steps :

1. Put the alarm clock on the air vacuum pump and cover it by the glass jar (Fig.17)
2. Evacuate the air inside the jar partially by drawing the arm of the vacuum pump outwards.
3. Compare the sound intensity before and after the evacuation of air.

.....

Explanation:

The air density decrease as you pull the air vacuum pump outwards.

Enrichment information and activity (4)

- Sound intensity of a fired shot on the top of a mountain is less than that at the surface.
- Why does the sound intensity differ on both regions? _____

Conclusion :

Sound intensity increases as the density of the medium through which the sound travels increases.

5 Wind direction:

When the wind direction is the same as that of sound waves propagation, sound intensity increases and the intensity decreases when the wind is flowing in the opposite direction.

Real Life Application: Ear Plugs

Ear plugs made of silicon are sold in pharmacies. They take the shape of the external ear canal, where these plugs are used to avoid the hazards of noise in loud places.

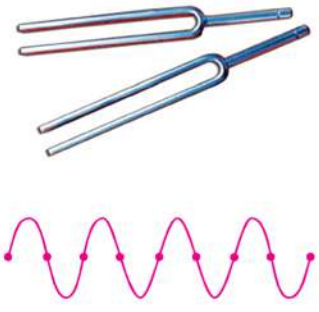
3 Quality of Sound

Self enquiry:

Have you asked yourself…why the ear is able to distinguish between the musical tones produced by a violin and a piano even if they emit a tone of equal pitch and intensity?

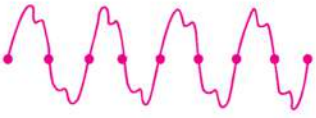
Communication

Take part in performing the following activity with you classmates in, under supervision of your teacher, to find out the reasons beyond the different sounds produced from different sources.



Tone produced from a vibrating tuning fork
Fig. (18)

Tone produced from a violin
Fig. (19)



Tone produced from a piano
Fig. (20)

- A pure and simple tone is produced from a vibrating tuning fork, and known as the fundamental tone Fig. (18)

  On the other hand, the tones produced from a violin Fig. (19) and the piano Fig. (20), even if they are equal in pitch and intensity, they are complex tones composed of a fundamental tone associated by other tones higher in pitch and lower in intensity.

  These are called harmonic tones. These harmonic tones differ depending on the nature of the sound source.

The property, by which the ear can distinguish between different sounds according to the nature of the source, even if they were of the same pitch and intensity, is called sound quality.

Comparing sound waves according to frequency :

Fig.(22) shows the range of sounds produced and heard by some living organisms.

Why do you think dogs are able to hear all sounds produced by humans?

.....

.....

And why humans are unable to hear all sounds produced by dolphins?

.....

.....

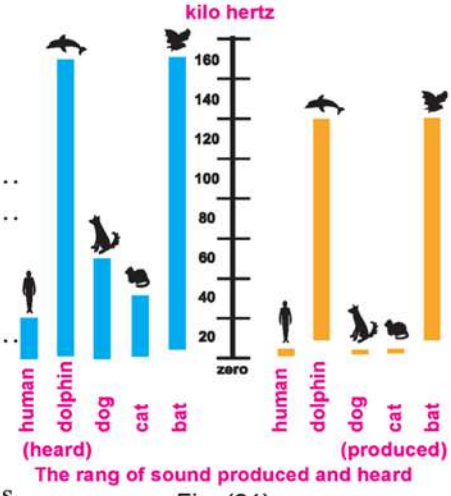


Fig. (21)

The human ears are affected by sounds of a frequency range between 20 Hz – 20 KHz

According to this frequency range heard by humans, sound waves are classified into:

- Sonic waves of frequency range between 20 Hz – 20 KHz
- Infrasonic waves of frequency less than 20 Hz Such as that of storms preceding rain fall.
- Ultrasonic waves of frequency more than 20K Hz such as that produced by sonar devices or some animals.

Mention the names of some of such animals.

.....

.....

Enrichment information (5)

- When the Ethiopian chickens that live in Africa Fig. (22) depart their home suddenly, this gives an indication of rain fall the day after.
- This is explained by their high sensitivity to the infrasonic waves associating weather changes preceding rain fall.
- On the other hand, some sea creatures like shrimps and whales produce ultrasonic waves as sound shots to kill the fish they feed on.

Ethiopian chikens
Fig. (22)

Real Life Application: Ultrasonic Waves

- Ultrasonic waves are used in several medical, industrial and military fields such as:

  - Breaking down kidney and ureter's stones without any surgical intervention.
  - Diagnosis of male prostate gland tumors and its effect on bladder and in discovering malignant tumors. Fig. (23)
  - It is also used to sterilize food, water and milk. Fig. (24) as it is characterized by its high ability to kill some types of bacteria and stop the action of some viruses.
  - Recently scientists are using it in the discovery of land mines.

Sonar
Fig. (23)

Milk sterilizer
Fig. (24)

Enrichment information (6)

- When ultrasonic waves collide with land mines, they vibrate. And due to this vibration, it produces waves that travel through the earth's surface to be discovered by using a specialized laser device.
- Read and collect information and data from newspapers, magazines, scientific encyclopedia, and the internet about land mines problem in Alamain, in the North Coast since 1942.

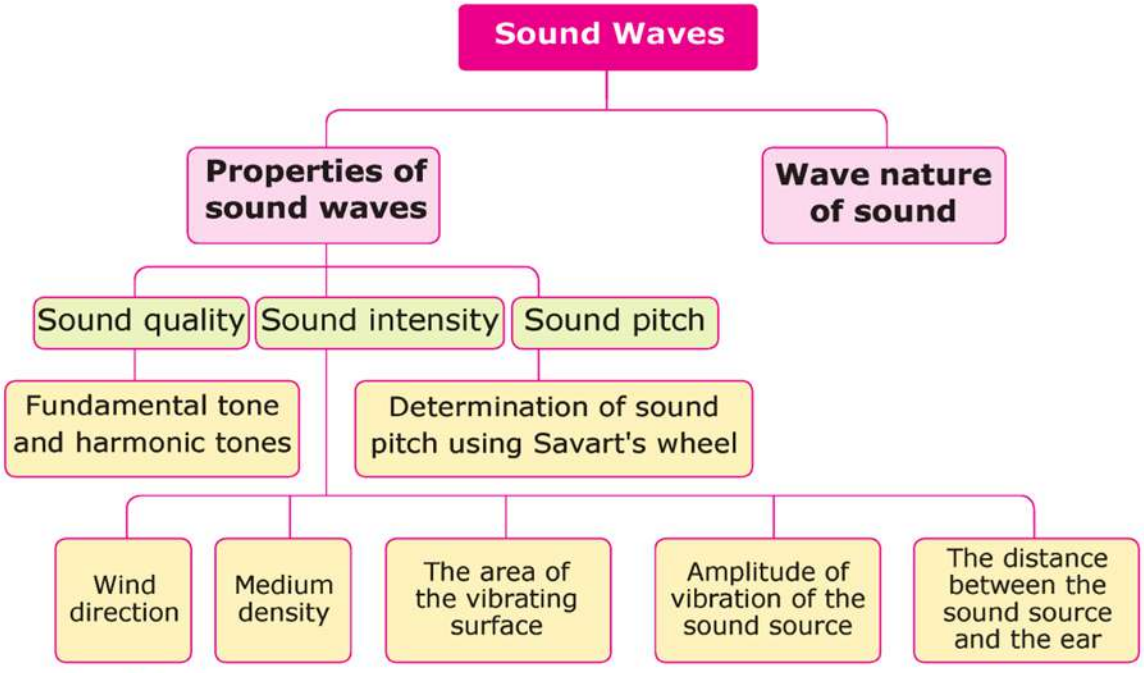
Discussion issue **Neighbor rights**

- A family decided to make a wedding ceremony at their home. The date of the wedding was at the time of the final examinations. Their neighbors are bothered by the loud sound of the amplifier.

Discuss this case with your classmates, under the supervision of your teacher, making the following questions part of your discussion:

- Is the party time a personal decision or the family should inform the neighbors to determine whether it is fine with them or not?
- Should the neighbors be patient till the end of the party or should they take action and prevent it immediately?
- Do you prefer to call the police instead of talking to the family setting up the ceremony?
- Do you agree to use violence when the two parties fail to reach an agreement?

Lesson summary



- Sound pitch is the property by which the ears can distinguish between sound levels, either sharp or harsh.
- Sound intensity is the property by which the ears can distinguish between sounds either strong or weak.
- Sound quality is the property by which the ears can distinguish between sounds with respect to the nature of the source even if they are equal in pitch and intensity.

Lesson One Assessment

1 Choose the correct answer from those between brackets:

(a) The human ear can distinguish sounds of frequency …….

(50 kHz – 30 kHz – 300 Hz – 50 Hz)

(b) A sound wave travels in air with velocity 330 m/s and has a wavelength of 0.1 m, its frequency is…….

(330 kHz – 3300 Hz – 33 kHz – 330 Hz)

(c) All of the following are factors affecting sound intensity except …….

(amplitude of vibration – frequency – medium density – wind direction)

2 What is meant by each of the following?

(a) Sound pitch……...

(b) Sonic waves…….

(c) The wavelength of a sound wave = 1.5 m

……

3 Give reasons for each of the following:

(a) The piano sound differs from that of a violin even if they have the same pitch and intensity.

……

(b) Sound traveling in air has less intensity than that travelling in carbon dioxide.

……

(c) The use of ultrasonic waves in milk sterilization.

……

4 Savart's wheel rotates with a rate of 300 cycles per minute. A sound of frequency 600 Hz is produced when an elastic plate touches the teeth of the gear. Calculate the number of teeth of the gear.

……

……

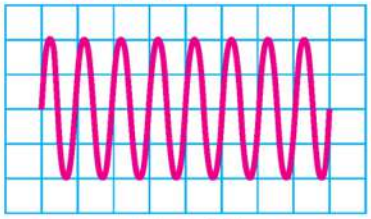
Illustrate using a practical activity the effect of medium density on sound intensity.

……

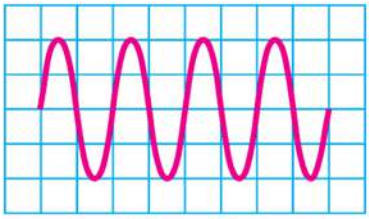
……

……

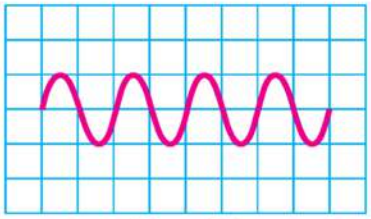
5 Using the opposite figures, compare from the point of view of sound intensity and pitch between;



Wave (A)



Wave (B)



Wave (C)

(a) sound wave (a) and sound wave (b)

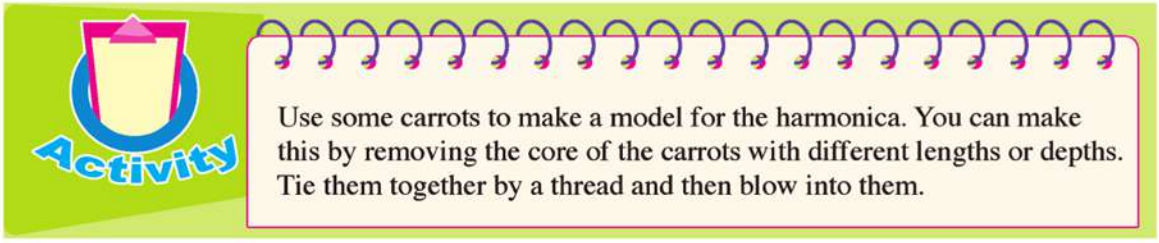
.....

(b) sound wave (b) and sound wave (c)

.....

6 Creative Thinking :

Name as many instruments as you can that can produce musical tones and those that produce noise.



Use some carrots to make a model for the harmonica. You can make this by removing the core of the carrots with different lengths or depths. Tie them together by a thread and then blow into them.

Lesson 2

Reflection of Sound Waves

Lesson objectives

By the end of studying this lesson, the student should be able to:

1. Conclude the laws of reflection of sound.
2. Identify the concepts related to the laws of reflection of sound.
3. Define the concept of echo.
4. Use materials and tools to prove the laws of sound reflection.
5. Identify real life applications of echo.
6. Like working with others.
7. Appreciate the importance of science and technology in human life and society.
8. Be accurate and scientifically honest in dealing with events and phenomena.

Elements of the lesson

1. Laws of reflection of sound.
2. Concepts related to sound reflection.
3. Echo.
4. Real life applications for echo.

Involved Issues:

1. Encouragement of domestic tourism.
2. Scientific honesty.

Self enquiry:

Have you asked yourself once:

- Why the roofs of worship places are built in the form of domes? Fig. (1)
- Why are the ears of the gazelle big? Fig. (2)
- How can we know the sex of the embryo before birth? Fig. (3)

Communication

Discuss with your classmates under the supervision of your teacher to find out the answers to these questions.

Dome of rock
Fig. (1)

The big ears of gazelle
Fig. (2)

Embryo before birth
Fig. (3)

Reflection of sound:

When sound waves fall on a reflecting surface and return back in the same medium, in the form of reflected waves,
one could say that sound reflection took place.
Fig. (4)

Sound reflection
Fig. (4)

Exercise (1)

Conclude a definition for the phenomenon of sound reflection.

.....

It was found that sound waves are governed by two laws when reflection takes place. These laws are known as the laws of sound reflection.
To prove this practically, you can take part with your classmates in a co-operative group, to perform the following activity.

Activity (1) Verifying the laws of sound reflection .

Fig. (5)

Materials and tools :

- Wooden plate.
- Foam plate.
- Table.
- Two cardboard tubes, one of them contains a cell phone.

Steps :

Participate with your mates in performing the following activity as illustrated in Fig. (5).

1. Fix the tube (b) and move the tube (a) to the right and left on the table till you hear the clearest sound.
2. Repeat the previous step several times, each with a different angle between the tube (b) and the foam plate.

Observations:

1. When can you hear the clearest sound in each trial?
   .....
2. What will happen when tube (b) is moved upwards in order to change its horizontal level?
   .....

To identify some concepts related to the phenomenon of sound reflection, you can participate with your mates in doing the following activity:

Activity (2) Identification of some concepts related to sound reflection

1. Join the point of incidence (x) on the reflecting surface with the point (y).
   A dotted line should represent the normal at the point of incidence to the reflecting surface. Fig. (6)
2. If the direction of the line of propagation of sound wave is called a sound ray, what does each of the following represent?
   a. Sound ray $\overrightarrow{ax}$?.....
   b. Sound ray $\overrightarrow{xb}$?.....

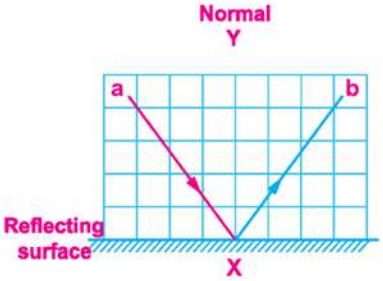


Fig. (6)

3 Conclude the name of the angle enclosed between each of:

a. The incident sound ray and the normal at the point of incidence to the reflecting surface .....

b. The reflected ray and the normal at the point of incidence to the reflecting surface .....

4 What's the relation between the angle of incidence and the angle of reflection?

.....

5 Do the incident sound ray, the reflected sound ray and the normal at the point of incidence lie in the same plane, or in more than one plane?

.....

Form the above two activities, the laws of sound reflection are made clear, and they are:

- The first law: angle of incidence = angle of reflection.
- The second law: the incident sound ray, the reflected sound ray, and the normal to the reflecting surface at the point of incidence, all lie in one plane perpendicular to the reflecting surface.

Enrichment information (1)

- The ceilings and walls of broadcast studios are covered with felt or rubber to absorb and prevent reflection

Exercise (2)

What will happen when a sound ray is incident perpendicularly to a reflecting surface? Fig. (7)

.....

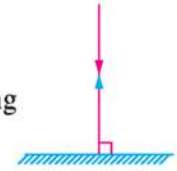


Fig. (7)

Echo

During the mid year holiday, you and your friends have been in a journey to Luxor and Aswan. While you were in the Kebash Corridor in Karnak temple, Fig. (8), one of the visitors had shouted loudly, and then he heard a very weird thing!!

What was it? What is the name of such phenomenon? And how does it occur?

The phenomenon of the repetition of hearing the original sound due to its reflection is called echo.

The kebash corridor in karnak temple
Fig. (8)

Conditions for hearing echo:

To hear echo, Fig. (9), it requires the presence of a wide and big reflecting surface such as walls, mountains or watery landscapes.

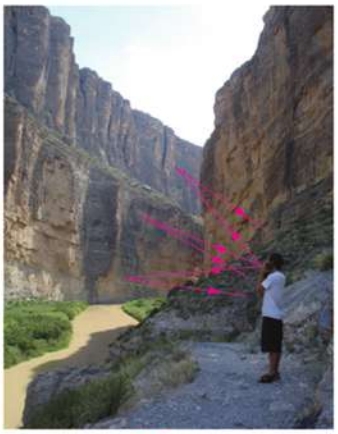
The time taken between hearing the original sound and its echo should not be less than 0.1 seconds.

Do you have an explanation for that?

……..

Sensation of our ears with sound lasts for a period of 0.1 seconds after hearing the original sound.

And as sound travels 340 meters in one second, then sound would travel a distance of 34 meters in 0.1 seconds back and froth.



Echo
Fig. (9)

Exercise (3)

What is the least distance between the sound source and the reflecting surface, which can guarantee the hearing of an echo?

……..

Enrichment information and activity (2)

- When the distance between the source of sound and the reflecting surface is multiplies of 17 meters (twice or three times), the echo is heard in the form of the last two or three phrases of the whole produced sound.
- Can you determine the distance between you and the reflecting surface using the number of segments heard from the echo?

Real Life Application: for Echo:

There are many applications of echo in different fields whether scientific, technical or medical. These applications include;

1 Determination of the speed of sound in air:

- To calculate the speed of sound in air, follow these steps:

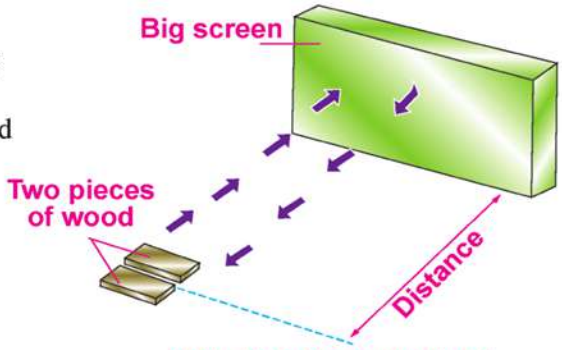
(a) Stand at a far distance away from a big screen. Then produce a sound, may be by using two pieces of wood.

(b) Record the time in seconds between the moments of producing sound and hearing echo.

(c) Repeat the above step several times to find the average time. And by knowing:

- The distance between the source of sound and the reflecting surface in meters.
- The average time (t) to hear the echo in seconds.

You can calculate the velocity of sound in air using the relation;



Calculate the velocity of sound in air

Fig. (10)

The velocity of sound (v) =

$$\frac{\text{twice the distance between the source of sound and the reflecting surface (2 d)}}{\text{the average time of echo in seconds (t)}}$$

Exercise (4)

A girl stood at the shore of an island and made a sound. Its echo was heard after 3 seconds Fig. (11)

Calculate the distance between the shore and the cliff given that the velocity of sound in air in this region is 330 m/s.

Fig. (11)

∴ v = ……..÷……..

∴ d = ……....x……../…… = ……..x……../…… = ……meters

2 Concentration of Sound:

- When sound reflects from a concave surface, sound waves collect at a point known as the focus of the surface. That leads to the reinforcement of sound. This phenomenon is called concentration of sound. This phenomenon is applied by sound engineers when building worship places (Fig. 12) and big conference halls, where concave walls and ceilings are built to concentrate sound at certain points to increase sound clarity.

The dome of Elaksa mosque
Fig. (12)

Exercise (5)

Why does the fink fox Fig. (13) have a high hearing sense?
.....

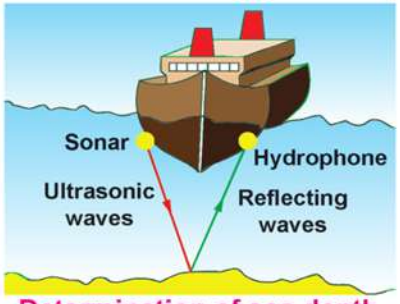
Fink fox
Fig. (13)

3 Determination of sea depth and fish shoals:

- There is a sonar device at the bottom of the ship. Its function is to produce ultrasonic waves. Also, a hydrophone set to receive these waves after being reflected from sea bed (or fish shoals) Fig. (14)

- By knowing the velocity of ultrasonic waves in water (v), the time interval between transmitting and receiving the waves «echo time» (t), the depth of the sea or the location of fish shoals can be determined by the relation:

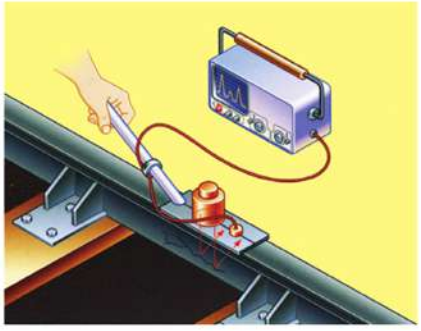
$$\text{The depth (d)} = \frac{\text{velocity of waves (v) x echo time (t)}}{2}$$



Determination of sea depth
Fig. (14)

4 Detecting industrial defects:

- Disasters can happen when some hidden cracks are present in metallic pipes as those used in conveying natural gas or parts of nuclear reactors.
- These cracks, holes, air bubbles and welding defects can be detected by passing ultrasonic waves through the material to be examined, Fig. (15). Defects in manufacture can be detected through the variation in the intensity (amplitude of vibration) of the reflected waves.



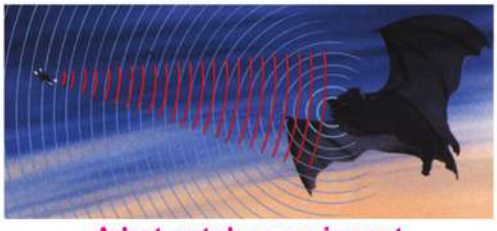
Detecting industrial defects
Fig. (15)

5 Medical diagnosis:

Ultrasonic waves are used in medical investigations and laboratory tests, as in detecting the sex of the embryo and its health condition, Fig. (16).
This is based on the ability of different parts of the body to reflect ultrasonic waves in various intensities.

Medical diagnosis
Fig. (16)

- Some animals, as bats, uses the phenomenon of echo to locate the position of its prey. This is achieved by transmitting ultrasonic waves (50 :100 kHz) and receiving it after reflection. Fig. (17).
- In the same way, dolphins can avoid obstacles in their way.

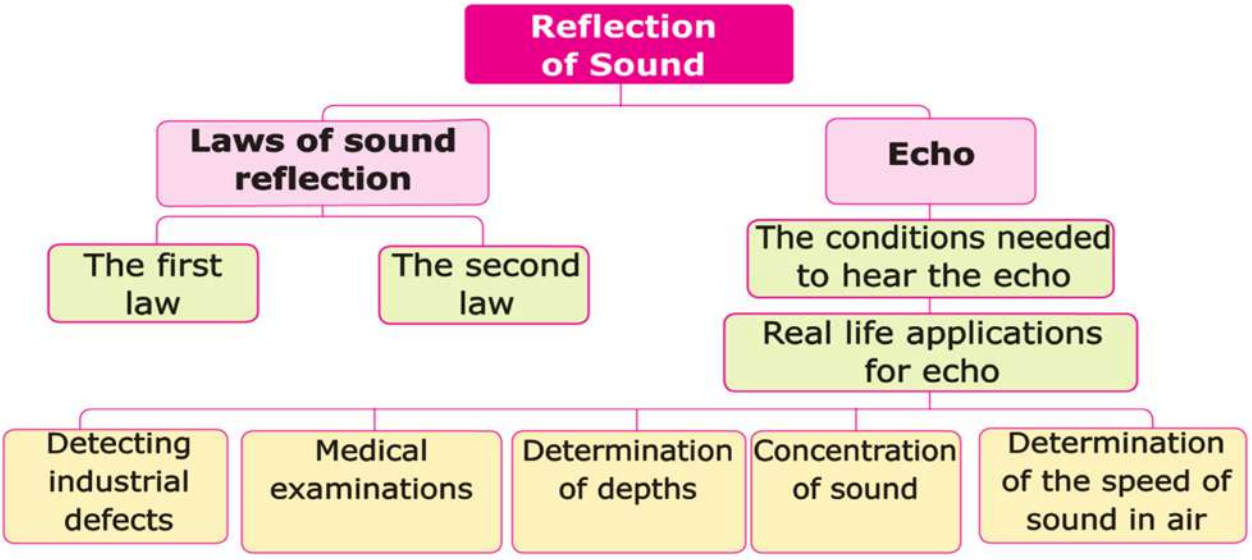


A bat catches an insect
Fig. (17)

Real Life Application: Noise Reduction:

Put a piece of moquette or rubber under the vibrating washing machine, while getting rid of water, to absorb the noise produced due to vibration instead of its reflection from the glistening surfaces of walls.

Lesson summary



- The first law of sound reflection: angle of incidence = angle of reflection.
- The second law of sound reflection: the incident sound ray, the reflected sound ray, the normal at the point of incidence to the reflecting surface all lie in the same plane, perpendicular to the reflecting surface.
- Echo: is the repetition of the original sound due to its reflection.

Lesson Two Assessment

1 Write down the scientific term for each of the following statements:

(a) Angle of incidence = angle of reflection . (.....)

(b) Repetition of the original sound due to reflection. (.....)

(c) Conversion of sound at a point due to its reflection on a concave surface. (.....)

2 What are the conditions required to hear an echo?

.....

.....

3 Give reasons for each of the following:

(a) The ears of the fink fox are big and concave.

.....

(b) Dolphins don't hit any sea obstacles during swimming.

.....

4 An ultrasonic wave is produced by a ship. The wave hit the sea bed and returned back after 0.1 seconds. Calculate the depth of the sea given that the velocity of the wave in water is 1490 m/s.

.....

.....

5 Mention some real life applications for echo.

.....

.....

.....

.....

6 A person stood between two mountains and he was nearer to one of them than the other. When he produced a sound, its echo was heard twice. The first one after 1.4 seconds from the moment of hearing the original sound. The second one was heard after 1 second from the first echo.

Calculate the distance between the person and the two mountains, given that the velocity of sound in air is 340 m/s.

.....

.....

7 Creative Thinking:

Write down some questions about sound, where each question begins with a word from list (a) followed by a word from list (b), then answer these questions.

List (a): what, when, how, which, why.

List (b): Proceed, repeat, it, stop, arise.

.....

.....

.....

.....

.....

Activity

Collect five colored pictures of animals characterized by their big sized ears, and write below each picture, the name of the animal and the sound it produces.

Lesson 3

Wave Nature of Light

Lesson objectives

By the end of studying this lesson, the student should be able to:

1. Define the wave nature of light.
2. Define the speed of light.
3. Use the materials and tools to analyze white light.
4. Describe light behavior in different media.
5. Use the materials and tools to prove that light travels in straight lines.
6. Identify light intensity.
7. Recognize the inverse square law for light.
8. Appreciate the importance of co-operation and team work.
9. Appreciate the importance of optics and vision in life.
10. Appreciate the importance of traffic awareness and protecting the lives of people.

Elements of the lesson

1. Definition of light waves.
2. Analysis of white light.
3. Light behavior in different media.
4. Traveling of light in straight lines.
5. Light intensity.
6. Inverse square law of light.

Involved Issues:

Traffic awareness and protecting the lives of people.

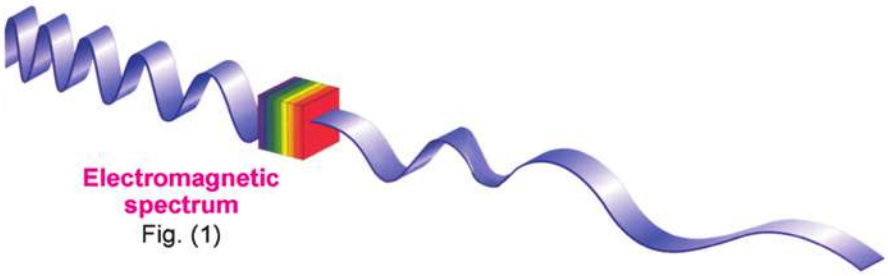
- You have studied in unit one the different types of waves and learnt that the nature of light waves differ from those of sound waves.

Self Enquiry:

You might have asked yourself….What is the nature of light waves? What is their composition? How fast does light travel in space?

Communication

Discuss with your classmates, under the supervision of your teacher, the answers to these questions.



Electromagnetic spectrum
Fig. (1)

Visible light is one of the waves present in the electromagnetic spectrum Fig. (1).
Its wavelength ranges between 380 – 700 nanometers.
The speed of light is the distance covered by light in one second.

Enrichment information (1)

- Al-Hassan bin Al-Haytham was the first scientist who built up the fundamentals of the science of light and optics. He discovered the phenomenon of the camera which was the base for the invention of the camera we have today. He was also the first one who explained the mechanism of vision correctly.

Analysis of white light:

Sun is the main source of light on Earth. To know the components of light coming out of the sun (white light), you can take part in the following activity with your classmates:

Activity (1) Analyzing white light

Compact Disks
Fig. (2)

Put a compact disk (CD) on the surface of a table. (Fig. 2), making sure that the glistening surface of the disk faces a source of white light as sun rays.

What do you notice?

.....

.....

Conclusion :

White light consists of a mixture of seven colors known as the colors of spectrum.
These colors are: red, orange, yellow, green, blue, indigo and violet.

Triangular prism
Fig. (3)

- A glass triangular prism is used to analyze white light into the seven colors of spectrum. Fig. (3)
  - Which spectral color has the least deviation (the color closer to the prism apex)?
    .....
  - Which spectrum color has maximum deviation (the color closer to the prism base)?
    .....

Enrichment information (2)

Table (1)

Color of light	Violet	Indigo	Blue	Green	Yellow	Orange	Red
Wavelength (nanpmeter)	350 : 400	400 : 450	450 : 500	500 : 550	550 : 600	600 : 650	650 : 700

Table (1) shows the wavelengths of the components of white light.

The German scientist Max Planck proved in 1900 that the energy of light wave consists of packets (quanta) of energy known as photons.
The energy of the photon is directly proportional to the frequency of the light wave.

Enrichment information (3)

- Max Planck is a German scientist who gave his life for physics and music. He is the founder of the quantum theory. In 1918 he won Nobel Prize.

Photon energy $\propto$ the photon frequency

- The energy of the photon = constant x the frequency of the photon.
  This constant value is known as Planck's constant.

Exercise (1)

Fig. (4)

Which one has a greater energy; the photon of red light or the photon of the violet light? Given that the frequency of red light is less than that of violet light.

.....

.....

Real Life Application: Spot Lights

Light can be used in home decorations like the use of spot lights to illuminate artifacts, and ornamented lamps that bring happiness and joy to the place, also the use of stand lamps that concentrate light for reading. (Fig. 5)

Fig. (5)

Activity (2) Light Behavior in Different Media:

Participate with your classmates in doing the following activity, where one of you should record the observations on how clear or unclear the vision is, in the following cases, by placing a (√) mark in the appropriate cell in table (2).

Cases of looking at.....	Range of vision		
	Clear	Unclear	Unseen
1. The title of a book placed on the desk.	✓	.....	.....
2. The title of the book when placing a layer of clear plastic on it.	.....	.....	.....
3. The title of the book when placing many layers of clear plastic on it.	.....	.....	.....
4. The title of the book when placing a plant leaf on it.	.....	.....	.....
5. A coin in a glass of water.	.....	.....	.....
6. A coin in a glass of milk.	.....	.....	.....
7. The filament of a lamp whose bulb is made of flint glass.	.....	.....	.....

Conclusion :

1. According to the ability of media to allow light to pass through, they are classified into:
   - Transparent medium: that permits the light to pass through it, as air and pure water.
   - Opaque medium: that does not permit light to pass through it.
   - Translucent medium: permits only a part of the light to pass through it and absorbs the remaining part, as flint glass.
2. As the thickness of the transparent medium increases, its permeability for light decreases.

Exercise (2)

How could you explain the inability to see fishes at the bottom of the river Nile, though water is a transparent medium?

.....

Fig. (6)

Traveling of light in straight lines:

Light propagates through transparent media in straight lines Fig. (6). The thickness of these lines can be controlled. You can participate with your classmates to carry out the following activity:

Activity (3) Demonstrate the propagation of light in straight lines

Materials and tools :

- Four cards.
- Pieces of plasticine.
- White paper plate.
- Light pen.

Steps :

1. Make an identical hole at the middle of three cards.
2. Fix the four cards using plasticine on the white paper plate, where the holes lie on the same line. Fig. (7)
3. Allow light of the light pen to pass towards the hole of card (a).

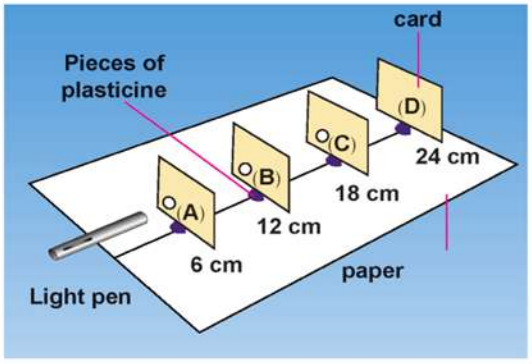


Fig. (7)

Enrichment information (4)

Lunar eclipse and solar eclipse are two phenomena explained on basis of travelling of light in straight lines.

Observations:

1. What do you see on the card (d)?

   .....

2. What do you expect to happen to the area of the formed light spot, if the size of the holes increase?

   .....

3. Can a light spot be formed on card (c) if card (b) is moved slightly to the left?

   .....

Conclusion:

Light can travel through transparent media in the form of straight lines, whose size (thickness) can be controlled.

Light Intensity (Brightness)

To identify the concept of light intensity (brightness) for a given surface, perform the following activity with your classmates:

Activity (4) Illustrating the concept of light intensity.

Steps :

1. Stand at 1 m apart from a wall in a dark room and direct the light of a torch towards it.
2. Repeat the above step several times, increasing the distance between you and the wall each time. Fig. (8)

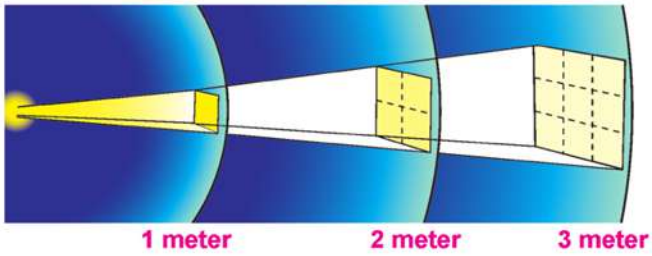


Fig. (8)

What do you observe?

Regarding the light intensity of the light spot formed on the wall as the distance between you and the wall increases?

.....

Explanation :

Light emitted form a source propagates in all directions, and as the distance between the wall and the light source increases, the quantity of light incident on the unit area of the surface decreases.

Conclusion :

1. The amount of light incident normally onto a unit area of a surface in one second is called light intensity.
2. Light intensity of a surface decreases as the distance between the surface and the light source increases.

- Light intensity of a surface is inversely proportional to the square of the distance between the surface and the source of light which is known as the inverse square law of light.

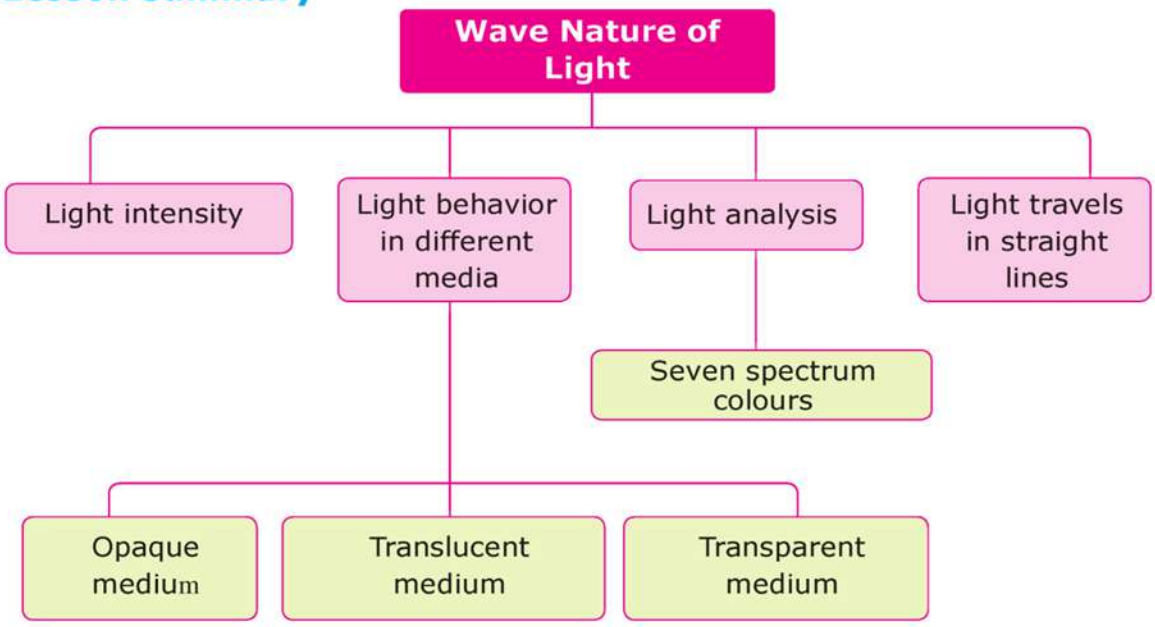
Discussion issue **Traffic awareness and protecting the lives of people.**

- Some people prefer to install mercury lamps in the head lights of their cars, as they give much brighter illumination that can penetrate fog. But, when this bright light is used at night, it can cause some visual impairment to the drivers coming in the opposite direction.

  Discuss with your classmates under the supervision of our teacher, this issue making the following questions a part of your discussion:

  - Do you have an idea about the items of the traffic law, concerning the use of bright lights and indicators? How could you get these items?
  - In your point of view, which one should lead the other, traffic awareness (understanding) or harsh punishment and penalties for outlaws?
  - Do you consider the benefit for others as you do for yourself?
  - Assuming that you were a car driver; would you break the laws of traffic, if you find this fulfills your benefit?

Lesson summary



- The speed of light: is the distance covered by light in one second.
- The energy of a photon = Planck's constant x the frequency of the photon.
- Light travels in different transparent media in the form of straight lines.
- Light intensity: is the quantity of light falling perpendicular to a unit area of a surface in one second.

Lesson Three Assessment

1 Choose the correct answer from those between brackets:

(a) Light waves are ……. .

(mechanical transverse – electromagnetic longitudinal – electromagnetic transverse)

(b) The human skin is considered ……medium.

(transparent – opaque – translucent)

(c) The quantum of energy of green light is…….the quantum of energy of yellow light.

(greater than – equal to – less than)

2 Choose the unsuitable word or statement out, and then express the rest of the words or statements with something proper:

(a) Yellow / blue / white / violet / red

……

(b) Light travels in straight lines / the speed of light differs in different media / white light consists of seven simple colors / light travels in materialistic media only / the thickness of a light beam can be controlled.

……

3 Give reasons for each of the following:

(a) The energy of red light photon is less than that of orange light photon.

……

(b) The inability to see the impurities present in black honey.

……

4 What's meant by……?

(a) Visible light.

……

(b) Light intensity.

……

5 Explain an activity to demonstrate that light travels in straight lines in transparent media.

……

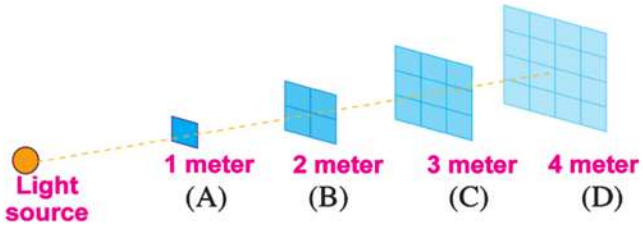
……

……

……

……

6 In the opposite figure, the light intensity of the surface at point (A), equals the unity. Choose from the following values



$(\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{6}, \frac{1}{9}, \frac{1}{12}, \frac{1}{16})$

what is suitable to be the light intensity at the points, (B), (C) and (D)?

.....

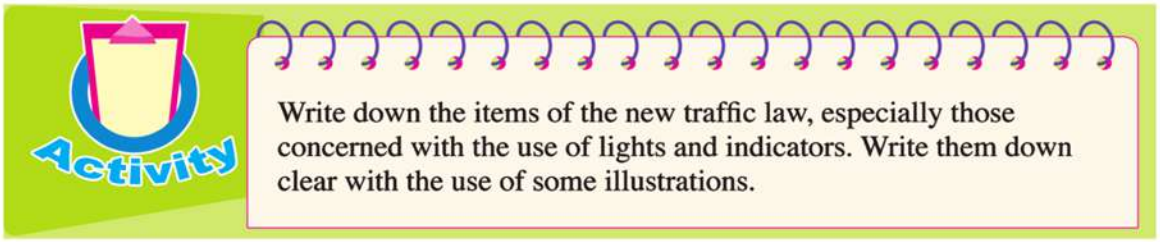
.....

.....

7 Creative Thinking:

Glass manufacturing factories in Egypt produce different types of glass, like transparent (clear) glass, flint glass and reflecting glass.

Mention some uses for each type, stating the reason.



Write down the items of the new traffic law, especially those concerned with the use of lights and indicators. Write them down clear with the use of some illustrations.

Lesson 4

Reflection and Refraction of Light

Lesson objectives

By the end of studying this lesson, the student should be able to:

1. Define the concept of light refraction.
2. Identity the laws of light reflection.
3. Use the materials and tools to deduce the laws of light reflection.
4. Identify some technological applications of light reflection.
5. Conclude the concept of light refraction.
6. Describe the angle of incidence, the angle of refraction and the angle of emergence.
7. Use the materials and instruments to prove the concept of light refraction.
8. Conclude the concept of optical density of a transparent medium.
9. State the laws of light refraction.
10. Define the absolute refractive index of a transparent medium.
11. Identify the critical angle and total internal reflection.
12. Enumerate natural phenomena that are related to light refraction and reflection.
13. Appreciate the role of science and technology in human life and society.

Elements of the lesson

1. Concept of light reflection.
2. The two laws of light reflection.
3. Technological applications of light reflection.
4. The concept of light refraction and the related concepts.
5. The laws of light refraction.
6. The concept of critical angle and total internal reflection.
7. Natural phenomena related to light reflection and refraction.

Involved Issues:

Endoscopy.

Self Enquiry:

Have you asked yourself, what was the reason behind the formation of shadows when the objects lie in the path of light? Fig. (1)

Fig. (1)

Communication

Think with your classmates under the supervision of your teacher about the reason of forming inverted images of the trees and buildings on the road when rain falls. Fig. (2)

All these observations are attributed to the phenomenon of light reflection, where light waves return back to the same medium of incidence when they meet a reflecting surface.

Fig. (2)

Types of light reflection:

- Reflection of light is classified into two types, which are:

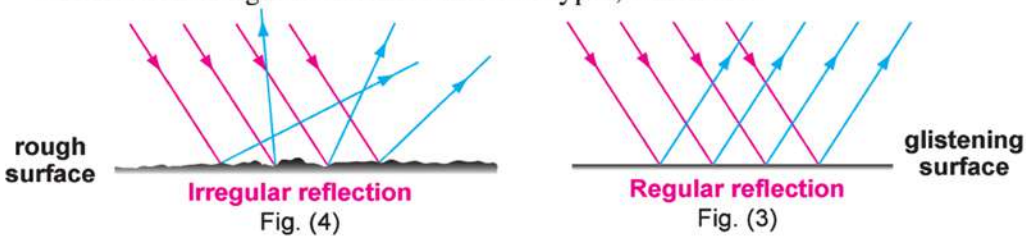


Fig. (4) Fig. (3)

1 Regular reflection:

In this uniform reflection, incident light rays reflect in one direction when they meet a uniform glistening surface. Fig. (3), like the surface of a plane mirror or a thin sheet of aluminum (foil)

2 Irregular reflection:

In the non-uniform reflection, the light rays return in different directions when they fall on a rough surface. (fig. 4), like a leaf of a tree or a piece of leather.

Enrichment information (1)

The surface of a clean mirror can not be seen as it reflects the incident light rays regularly. On the other hand a dirty mirror surface can be seen as it reflects light in an irregular manner.

Exercise (1)

What is the type of reflection when light falls on each of:

- a woolen jacket? .....
- a stainless steel sheet? .....

Laws of Light Reflection :

To identify the laws of light reflection, you can participate with your classmates in performing the following activity.

Activity (1) Identification of the laws of light reflection

Materials and tools :

- Plane mirror.
- Protractor.
- Laser pen.

Warning: Avoid exposing the eyes to direct Laser

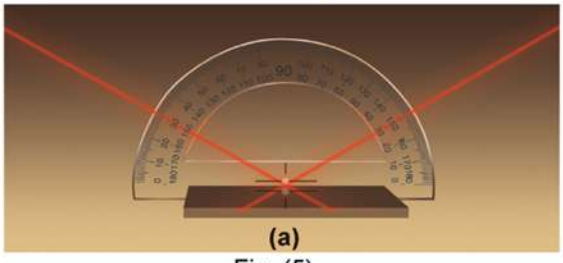


Fig. (5)

Steps :

1. Put the protractor in a vertical position perpendicular to the surface of the horizontal plane mirror placed on the surface of a table.
2. Direct a laser beam from the laser pen to pass the protractor surface at an angle of 30° and falls on the mirror at the point of incidence (a)

Observations:

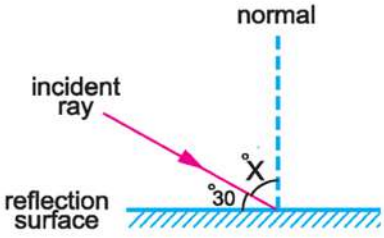


Fig. (6)

1. What is the name of the confined angle (x) between the incident ray and the normal at the point of incidence? What is its value?

   .....

2. What is the reading of the protractor at which the reflected ray passes the protractor? What is the value of the angle of reflection?

   .....

3. What is the relation between the angle of incidence and the angle of reflection?

   .....

4. What will happen when the light ray is incident:

   a. by an angle of incidence 45° .....

b. perpendicular to the surface of the mirror .....

5 Do the incident light ray, the reflected light ray and the normal at the point of incidence to the reflecting surface lie in one plane or more than one plane?

.....

Conclusion :

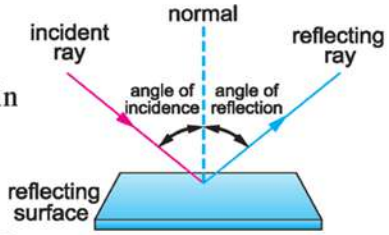


Fig. (7)

1 Reflection of light is governed by two laws, illustrated in Fig. (7).

The laws of light reflection:

a. The first law:

The angle of incidence = the angle of reflection

b. The second law:

The incident light ray, the reflected light ray, and the normal at the point of incidence to the reflecting surface, all lie in the same plane perpendicular to the reflecting surface.

2 When a light ray is incident perpendicular to the reflecting surface, it reflects back on itself, because the angle of incidence = the angle of reflection, equals zero. Fig. (7)

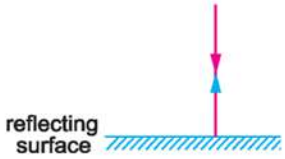


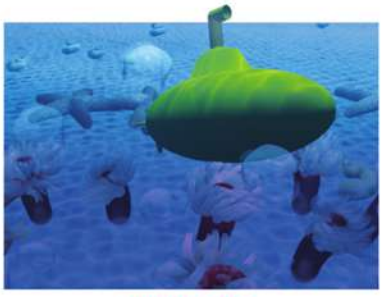
Fig. (8)

Technological Applications based on Light Reflection

1 The periscope :

It is used in submarines to see what is going on at the water surface. Fig. (9)

Also, it is used to see events happening behind a wall or a barrier, and in monitoring the dangerous chemical reactions in a laboratory. Fig. (10)


Periscope
Fig. (9)

Enrichment information and activity (2)

- The distance between the Earth and the Moon can be measured by the reflection of a laser beam directed from the Earth towards a reflecting surface placed on the Moon surface.
- Illustrate how can you calculate that?

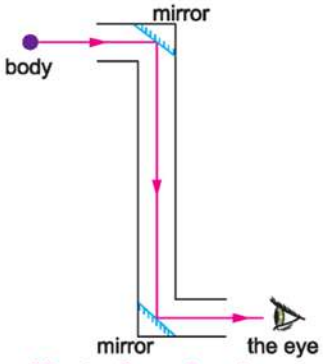
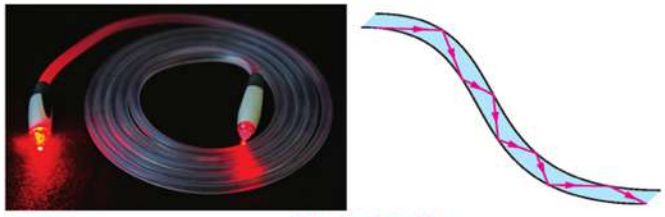


illustration of periscope
Fig. (10)

2 Optical fibers :

Medical endoscopes contain optical fibers, and used to diagnose some diseases and visualize injuries inside the body. They assist in doing high risk operations using lasers instead of traditional surgery. Fig. (11)



Optical fibre
Fig. (11)

Refraction of Light

How can you explain the changing path of a barrel pushed from asphalt to sand, then back again to asphalt? Fig. (12)

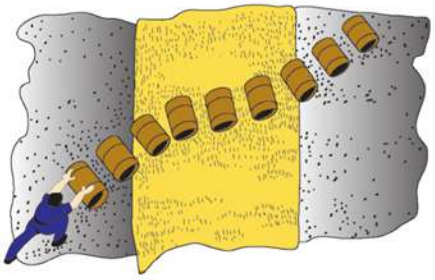
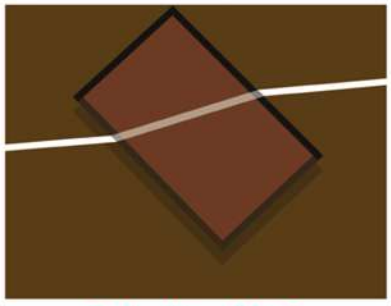


Fig. (12)

Does the velocity of the barrel vary on asphalt from that on sand?

- As Light travels from a transparent medium as air to another transparent medium as glass, behaves like the barrel that travelled from asphalt to sand. This phenomenon is known as refraction of light. Fig. (13)
- The ability of the transparent medium to refract light, is called the optical density of the medium.
- The optical density of a medium differs from one medium to another according to the speed of light in it. Before identifying the laws of refraction of light, Firstly, we have to define the concept of light refraction and some of the related concepts illustrated in the following activity :



Refrection of light
Fig. (13)

Activity (2) Demonstration of light refraction and some related concepts

Materials and tools :

- Thick rectangular glass block.
- Pencil.
- Protractor.
- White paper sheet.
- Ruler.
- Laser pen.

(Warning: Never expose the eye directly to laser)

Steps :

1. Put the rectangular glass block on the white paper sheet and mark the around the block using the pencil.
2. Direct a ray from the laser pen to the point of incidence (a) on the periphery of the rectangular prism and draw its path using the pencil and the ruler to represent the incident ray.
3. Draw the path of the emergent ray from the point (b) on the opposite side of the rectangular prism.
4. Remove the rectangular prism and join the two points (a) and (b) with a straight line to represent the refracted ray.
5. Draw at (a) and (b) dotted vertical lines, each represents the normal at the point of incidence on the boundary surface .

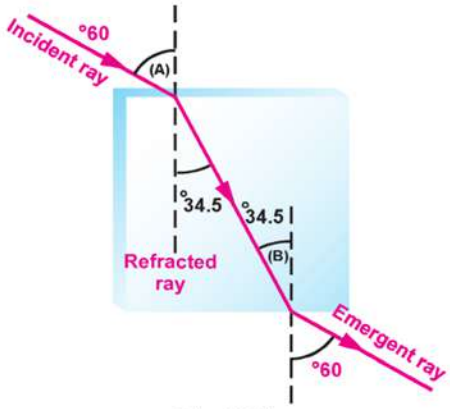


Fig. (14)

Observations:

1. What happened to the light ray when it travelled from air into glass then from glass into air ?

   .....

2. Deduce the name of the angle between each of :
   - The incident ray and the normal at the point (a) (.....)
   - The refracted ray and the normal at the point (a) (.....)
   - The emergent ray and the normal at the point (b) (.....)

Conclusion :

1. Changing the path of light when it travels from a transparent medium to another transparent one of different optical density is called light refraction.
2. The angel of incidence is the angle between the incident light ray and the normal at the point of incidence on the interface.
3. The angel of refraction is the angel between the refracted light ray and the normal at the point of incidence on the interface.
4. The angle of emergence is the angel between the emergent light ray and the normal at the point of emergence on the boundary surface.

Laws of Light Refraction

- When a light ray travels from a less optically dense medium as air to a more optically dense medium as glass, it refracts towards the normal at the point of incidence on the separating surface between the two media
  Which is greater angle of incidence or angel of refraction?
  .....

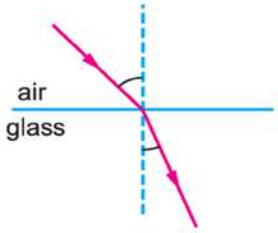


Fig. (15)

- When a light ray travels from a more optically dense medium such as glass to less optically dense medium as air, it refracts away from the normal at the point of incidence on the separating surface between the two media fig.

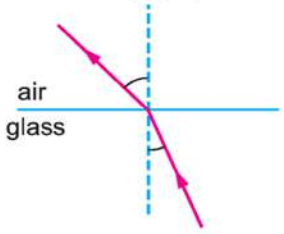


Fig. (16)

Exercise (2)

What would happen when a light ray is incident perpendicular to the separating surface between two transparent media of different optical densities?

.....

The ratio between the speed of light in air to that in another transparent medium is known as The absolute refractive index of that medium (n)

$$\text{The absolute refractive index (n)} = \frac{\text{Speed of light in air}}{\text{Speed of light in medium}}$$

The absolute refractive index of any transparent medium is always greater than one because the speed of light in air is always greater than that in any other transparent medium.

The medium of great absolute refractive index is described as being of higher optical density and vise versa.

Enrichment information (3)

The ratio between the absolute refrective index of a medium to the absolute refrective index of another medium is known as the relative refrective index.

Exercise (3)

Calculate the velocity of light in glass given that the velocity of light in air equals 3×10^8 m/s and the absolute refractive index of glass is 1.5

$$\text{The absolute refractive index of glass} = \frac{\text{.....}}{\text{.....}}$$

$$\text{The velocity of light in glass} = \frac{\text{.....}}{\text{.....}} = \frac{\text{.....} \times \text{.....}}{\text{.....}} = \text{.....} \times 10^8 \text{ m/s}$$

Critical Angle and Total Internal Reflection :

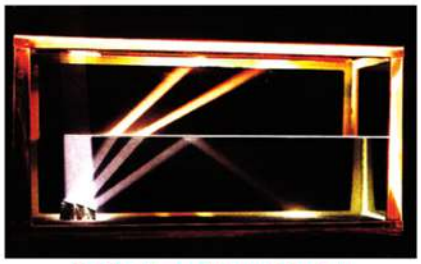
Before the recognition of some natural phenomena related to reflection and refraction of light, it is necessary to identify the concept of critical angle and total internal reflection by carrying out the following activity :

Activity (3) Indicating the concepts of the critical angle and total internal reflection :

Fix a source of light near the base of a trough filled with water at one of its sides to be able to control the angle of incident of the ray Fig. (17)

What do you notice when the angle of incidence of the light ray is :

- Less than 48.6° ? ……..
- Equal 48.6° ? ……..
- More than 48.6° ? ……..



Critical angle and total internal reflection
Fig. (17)

Explanation :

When the angle of incidence increases gradually, the angle of refraction increases too. And when the angle of incidence becomes of 48.6°, the light ray refracts tangent to the separating surface and such angle is known as the critical angle Fig. (18) which differs from one medium to another .

When the angle of incidence exceeds the critical angle, the light ray reflects instead of being refracted.

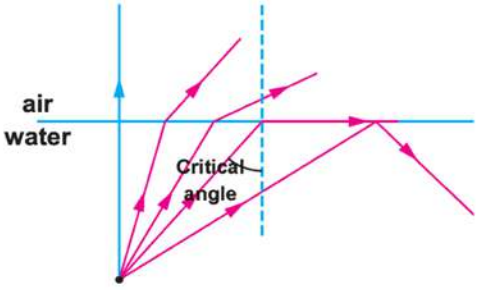


Fig. (18)

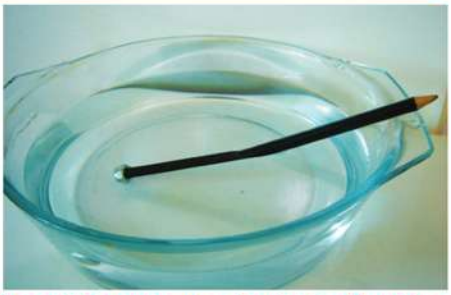
Conclusion :

1. When the angle of refraction in the less optical dense medium (As air) is 90°, the angle of incidence in the more optical dense medium (as water) is called the critical angle of this medium .
2. When the light ray is incident in the more optical dense medium with an angle greater than the critical angle of that medium , it reflects in the same medium which is known as total internal reflection.

Natural phenomena related to Reflection and Refraction of light

1 Apparent shapes of objects

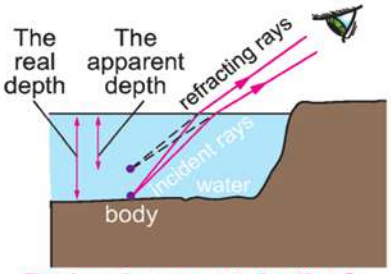
A pencil partially immersed in water appears as being broken . Fig. (19) that is due to the refraction of light rays coming from the immersed part in water .



Pencil's image due to light refraction
Fig. (19)

2 Apparent positions of objects:

The submerged object in water – as a fish – is seen in an apparent position slightly above its real position Fig. (20) due to the refraction of the light rays, coming from the object, away from the normal where the eye sees the fish on the extensions of the refracted rays.



Real and apparent depth of an object placed in water
Fig. (20)

3 Mirage:

A natural phenomenon takes place on the desert roads at noon especially in the summer times. Objects on the road sides seem as if they had inverted images on a wet area.
What is the reason beyond this phenomenon which is known as mirage?

- The air above the desert roads is heated at noon. Different layers of air of different temperatures are formed by the convection currents.

When an refract layers to earth object.
exists on the road side – as a tree- the coming rays from it refract several successive refractions on traveling from the higher cool layers to the lower hotter layers. At the hot air layer directly above the earth surface, total internal reflection happens to the rays from the object. This layer appears as a watery area and a virtual and inverted image is formed below the object. Fig. (22).

Mirage on road
Fig. (21)

Mirage on road
Fig. (22)

Enrichment Information (4)

*A group of refractions and reflections of sun rays occurs when it is incident on water drops or snow crystals suspended in air leading to analysing the light into a bow of spectrum colours known as rainbow. Fig. (23)

* Participate your partners to make an experiment to illustrate how umbra differs with the motion of the earth around itself .Write down a report about it.

Rain bow
Fig. (23)

Real Life Application: Project of Soap Bubbles Toy

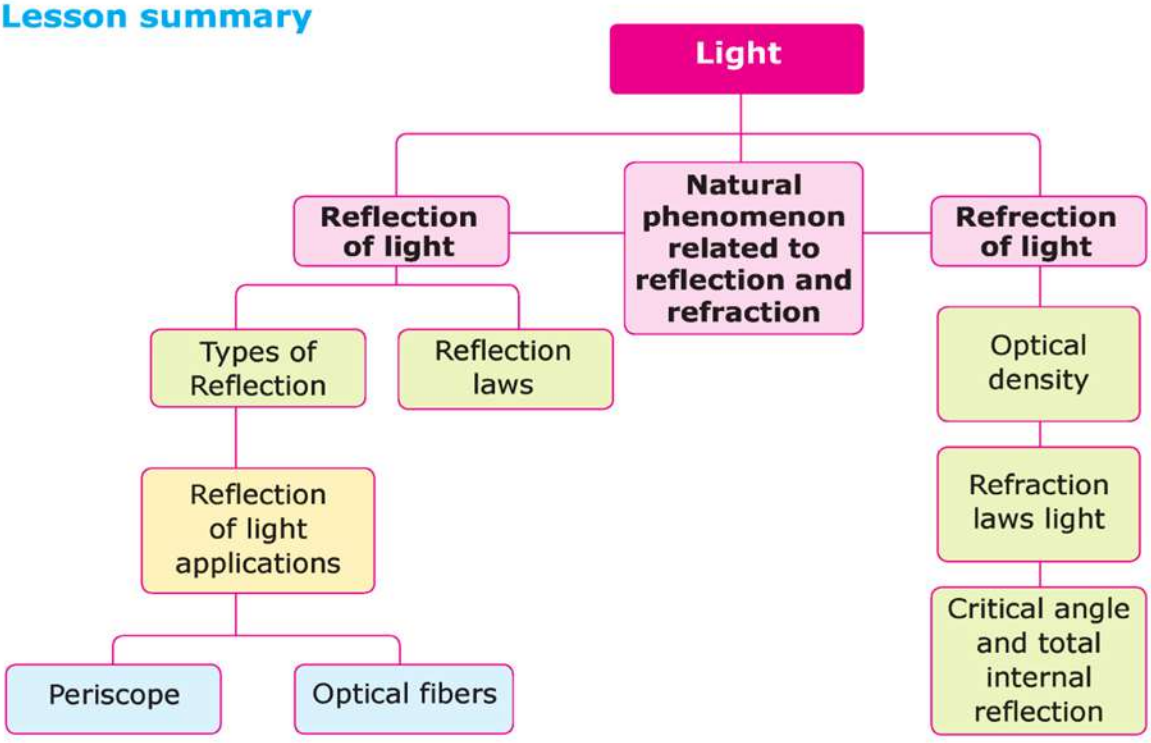
-You can make the project (soap bubbles toy) that can form the colours of spectrum when light is incident on it Fig. (24)
This is by adding an amount of liquid soap to water and drops of glycerine to increase the duration of bubbles existence in air.

Fig. (24)

Discussion issue **Endoscope Surgery**

- The medical endoscopes used in the diagnosis of some diseases , and performing surgeries are considered as one of the useful applications in medical fields. Discuss with your partners under the supervision of your teacher this issue. Let the following questions as a part of the discussion.
  - What are the operations in which the medical endoscopes are preferred than the traditional surgeries?
  - Why do some patients refuse to make medical examinations by using the endoscope?
  - What are the two different fields of science that you would like to be specialized in to serve the country?

Lesson summary



- Reflection of light: rebound of light waves in the same medium on meeting a reflecting surface.
- Refraction of light: changing the bath of light when it travels from a transparent medium to another transparent one of different optical density.
- The absolute refractive index of a transparent medium: is ratio between the speed of light in air to its speed in this medium.

Lesson Four Assessment:-

1 Write down the scientific term for each of the following statements:-

(a) The ability of the medium to refract light rays. (.....)

(b) The reflection in which the light rays recoil in one direction when incident on a glistening surface. (.....)

2 Complete the following statements:-

(a) Optical.....is used in medical.....that are used to perform dangerous operations without surgery.

(b) Angle of .....is the angle between the refracted light ray and .....at the point of incidence on the separating surface.

3 What is meant by .....?

(a) Absolute refractive index of water is 1.33

.....

(b) The critical angle of transparent medium with respect to air equal 40°

.....

4 Give reason for:-

(a) Occurrence of mirage phenomenon in desert regions at noon.

.....

(b) The light ray that is incident perpendicular on a glistening surface reflects on itself.

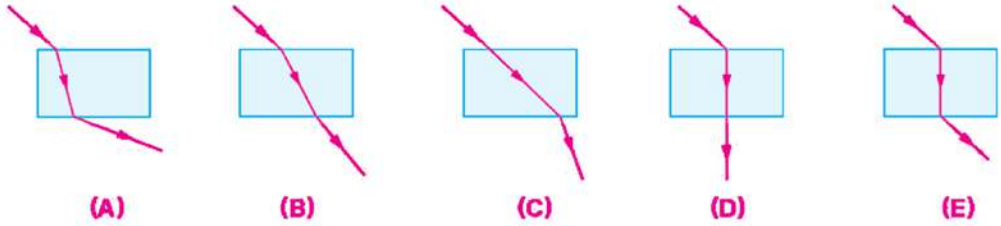
.....

5 Calculate the absolute refractive index of diamond given that the speed of light in it = 1.25×10^8 m/s.

.....

.....

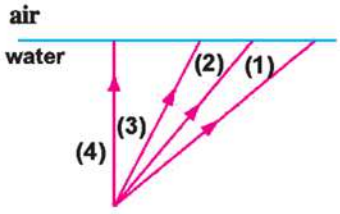
6 Choose from the following figures the one that express correctly the refraction of light in a rectangular glass block and mention the reason.



.....

.....

7 Complete the path of the light rays illustrated in the opposite figure given that the angle of incidence of the light ray (2) equal the critical angle.

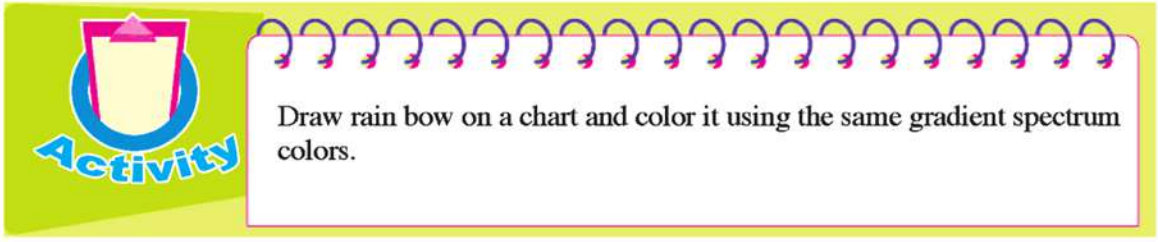


8 Creative Thinks:

During shaving chin or beauty care, would the light source of (spot) above the mirror in the bathroom be directed towards the person or the mirror? Why?

.....

.....



Draw rain bow on a chart and color it using the same gradient spectrum colors.

Unit two Assessment

1 Write down the scientific term for each the following statements:

(a) Sound waves of frequencies less than 20 Hz. (.....)

(b) A medium does not allow light rays to penetrate throw. (.....)

(c) Changing the path of light when travel from a transparent medium to another transparent medium of different optical density. (.....)

(d) The incident sound ray, reflected sound ray and the normal at the point of incidence on the reflecting surface all lie in one plane perpendicular to the reflecting surface. (.....)

2 Choose the correct answer between brackets, with scientific explanation:

(a) Sound of frequency 200 Hz is.... …. than sound of frequency 100 Hz.

(sharper / stronger / harsher / weaker)

……

(b) When the distance between the source of light and the surface as a wall decreases, the light intensity on the surface…….....

(decrease / increases / doubled / remains constant)

……

(c) ……..waves are used in medical examinations and identification of embryo sex and condition.

(sonic / infrasonic / ultra sonic / sonic and ultrasonic)

……

3 Write down the mathematical relation that joins between each of the following:

(a) The speed of sound (v) and the depth of body under water surface (d) using reflection of sound ....…….....……

(b) The photon frequency and its energy .....

c) The sound frequency (f), the number of teeth of the gear in Savart's wheal (n)……

……

4 What are the results due to each of the following?

(1) Incidence of light rays on a rough surface.....

(2) Incidence of a white light ray on one face of a triangular glass prism

.....

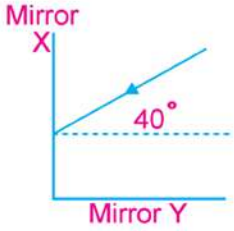
5 What is the scientific basis on which each of the following depends?

(1) The roofs of temples are built on the form of domes.....

(2) The strings of a musical lute are fixed on a hallow wooden box.....

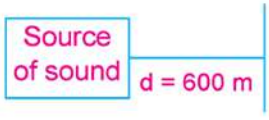
(3) Periscope.....

6 Complete the path of rays in each of the following figures according to what is written below each:



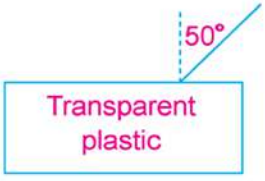
A-Determination of the angle of reflection of the ray on mirror (Y)

.....



B- Calculation of the Echo time given that speed of sound in air 340 m/s

.....



C- Calculating the angle of emergence from point (x) given that the optical density of air is less

.....

Reflection and self evaluation

Dear pupils after you have finished studying of unit two: Sound and Light, record your opinion and your point of view by answering the following questions.

(a) What are the useful subjects you have studied in this unit?

(b) What are the wrong ideas you had about some concepts and scientific phenomena and corrected due to the study of this unit?

(c) What are the difficulty that faced you with the study of this unit and doing the activity?

(d) What are the subjects that you have studied and you prefer if their content were revised to be suitable with your understanding?

(e) What is the subject that you suggest to study and not included in this unit?

Unit 3

Reproduction and continuity of species

Lessons of the Unit :

Lesson 1 : Reproduction in plants.

Lesson 2 : Reproduction in man.

Resources of knowledge and learning :

- **Books and scientific encyclopedia**

1 An approach to botany	Jean and Dorothy Paul.
2 Reproduction and growth	Dr. Richard walker.
3 Simple science	The age of cloning.
4 Life and man	Translated by Mejahed Maamoon.

Learning objectives of the unit

By the end of studying this unit, the student should be able to:

1. Recognize the structure of a flower (bisexual – male and female).
2. Deduce the functions of the bisexual flower's organs.
3. Determine the sex of the flower.
4. Deduce the types and methods of reproduction in plants.
5. Use the materials and tools needed to study the germination of a pollen grain.
6. Determine the concept of fertilization in plants.
7. Deduce the methods of asexual reproduction in plants.
8. Appreciate the importance of reproduction in plants in preserving species.
9. Appreciate the importance of plants in our life.
10. Appreciate the importance of science and technology in sound.
11. Recognize the structure of male and female genital system in man.
12. Deduce the functions of male and female organs of the genital system in man.
13. Compare between the functions of the human male and female genital system.
14. Draw an illustration for the sperm and ovum.
15. Describe the stages of embryo development inside the Uterus.
16. Identify some of the human genital system diseases in male &female human beings.
17. Preserve his health by preventing infection by the diseases of the genital system.
18. Commit to the healthy and right sexual attitudes.
19. Commit to the right religious and social ethics connected to the human nature.
20. Bear responsibility in preserving man own health and genital system.
21. Positively participate in social decision making regarding health issues concerned with preservation of man's health and birth control.

Lesson 1

Reproduction in plants

Lesson objectives:

By the end of studying this lesson, the student should be able to:

1. Describe the structure of the bisexual, male and female flowers.
2. Identify the functions of the calyx, corolla ,androceium and gynoecium.
3. Determine the sex of the flower.
4. Deduce the two types of reproduction in plants.
5. Remember the steps of sexual reproduction in plants.
6. Describe the types of flower pollination.
7. Identify the methods of mixed pollination.
8. Deduce the concept of fertilization in plants.
9. Use the materials and tools to study the germination of a pollen grain..
10. Define asexual reproduction in plants.
11. Conclude the types of vegetative reproduction in plants.
12. Appreciate the importance of reproduction in the continuity of species in plants.
13. Appreciate the importance of plants in our lives.
14. Appreciate the importance of science and technology in man's life and the society.

Elements of the lesson:

1. Structure of a typical flower.
2. The sex of the flower.
3. Types of reproduction in plants.

Involved Issues:

1. Investment and management of resources and their development.
2. The art of styling flowers.

- Walk around with your classmates in a public park or your school garden and watch the flowers with their joyful colors. Fig. (1)

Fig. (1)

The structure of a typical flower:

- A flower arises from a flowering bud, usually emerging from the axils of the leaf known as bract, and the axis may carry a number of flowers known as the inflorescence.Fig. (2)

To identify the structure of the typical flower, participate with your classmates in the co-operative group, in performing the following activity:

Inflorescence
Fig. (2)

Activity (1) Identify the structure of a typical flower:

Get a flower Fig. (3) examine it to identify its parts.

- Color the opposite figure of a typical flower. Fig. (4), using the same real colors of the original flower you have, then write down the labels matching with the parts of the floral whorl listed in table (1).

Fig. (3)

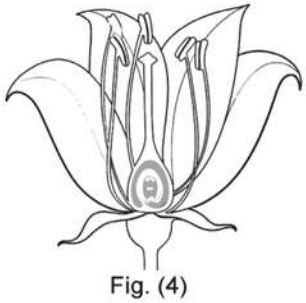
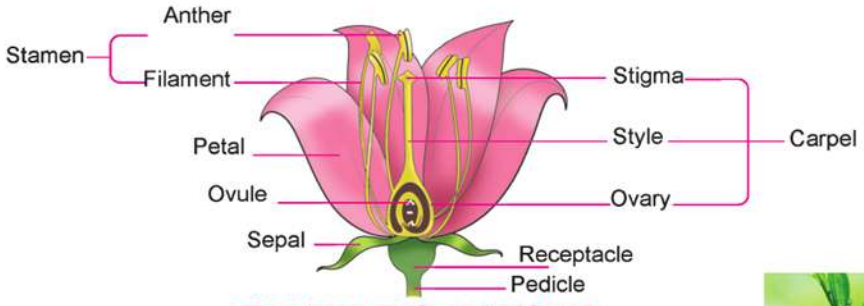


Fig. (4)

Table (1)

Floral whorl	Leaves of the Floral whorl	Description
Calyx	Sepals	Small green leaves, surrounding the flower from outside.
Corolla	Petals	Bright colored scented leaves.
Gynoecium	Stamen	Fine threads, ending with a bulge.
Androecium	Carpels	A hollow tube like a flask, that lies in the center of the flower.

From activity (1), you can recognize that a typical flower, Fig. (5), has a thin, fine neck ending by a bulging receptacle carrying floral leaves in four different floral whorls, which are the calyx, corolla, gynoecium and androecium.



The structure of a typical flower
Fig. (5)

1 The calyx:

The outer whorl of floral leaves is known as the calyx and its leaves are called sepals. Fig. (6), it's green in color and its function is to protect the internal parts of the flower specially before blooming.

Sepals surround the petals
Fig. (6)

2 The corolla

The whorl following the calyx, its leaves are called petals, Fig. (7) which is colorful and scented to attract insects, which help in the process of reproduction. The corolla function is to protect the reproductive organs.

The corolla petals
Fig. (7)

Exercise (1)

Compare between, wallflowers (Manthoor) flower and Petunia flower from the point of view of separation or fusion of the sepals and petals.

Table (2)

	Sepals	Petals
Wallflowers	.....	.....
Petunia	.....	.....

Enrichment information (1)

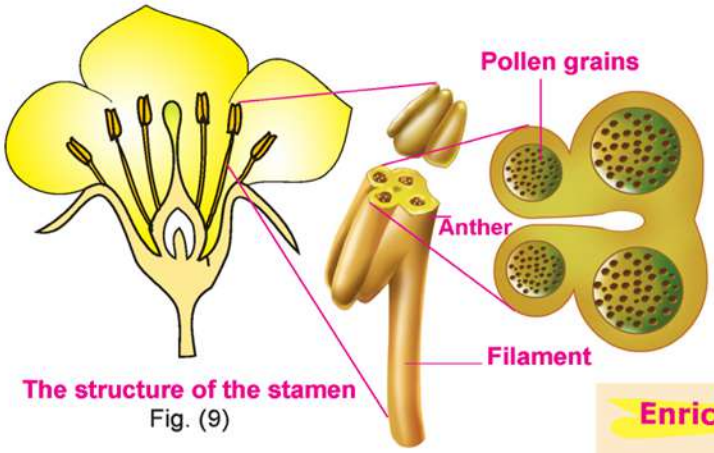
The sepals of corolla and petals of calyx might be of the same shape and color as in onion flower. That's why we call the two whorls together the Perianth.

3 Androecium:

The whorl following the corolla. Its leaves are called stamen, Fig. (8).

The stamen consists of a fine filament ending by a sac known as the anther which is divided into two parts, each of which has two chambers containing pollen grains, Fig. (9).

The stamens of the androecium
Fig. (8)



The structure of the stamen
Fig. (9)

Enrichment information (2)

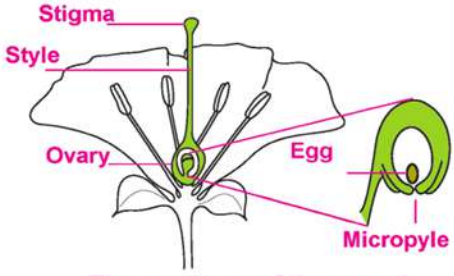
Hay- fever is a disease infecting people that have allergy to pollen grains. The symptoms of this disease are; inflammation of the mucus membrane of the nose, running nose, continuous sneezing and tear flow.

4 Gynoecium:

The fourth and innermost whorl of the flower. Its leaves are called crapels, which resembles the flask in shape and is formed of a bulge known as the ovary, Fig. (10), connected to a tube called the style which has an opening called the stigma. The ovary contains the ova.

- What is the name of the female reproductive organ in the flower?

  .....



The structure of the carpel
Fig. (10)

The sex of the flower:

To identify the sex of the flower, participate with your classmates in the co-operative group, to perform the following activity:

Activity (2) Identify the sex of the flower.

Examine samples of different flowers, like roses, wallflowers, petunia, peas, etc.....

Do all contain the male and female reproductive organs?

- Most flowers like tulip, petunia and wallflowers contain male and female reproductive organs together. This type of flowers is known as Bisexual (hermaphrodite) flowers, and its symbol is ⚥
- On the other hand some flowers contain only the male reproductive organ (androecium), and are said to be male flowers and has the symbol ♂ Fig. (11), unlike the female flower which contains only the gynoecium and its symbol is ♀, Fig. (12). The fore-mentioned flowers are known as unisexual flowers, like palms, maize and pumpkins.

Palm tree with a male flower
Fig. (11)

Palm tree with a female flowers
Fig. (12)

Exercise (2)

Mention the sex of each of the following flowers:

Flower: .....
Fig. (13)

Flower: .....
Fig. (14)

Flower: .....
Fig. (15)

Real Life Application: Drying-flowers

Pick up a bunch of flowers, and remove the lowermost leaves from the flower pedicle, and organize them in groups to be tied by the pedicle, (fig.16). Hang them in an upside down position in a dark, well ventilated room for one week.

Drying - Flowers
Fig. (16)

Reproduction in plants :

Self enquiry:

- Have you ever asked yourself, what are the types of reproduction in plants?
  Plants reproduce by flowers or by their green parts.
  In the following lesson we will discuss both types in details.

First: sexual reproduction in plants

Communication

Discuss with your classmates, under the supervision of your teacher, the following questions:

- Have you ever tried cultivating bean or lupine seeds?
- How were these seeds formed?
- Why do flowers disappear after seeds formation?

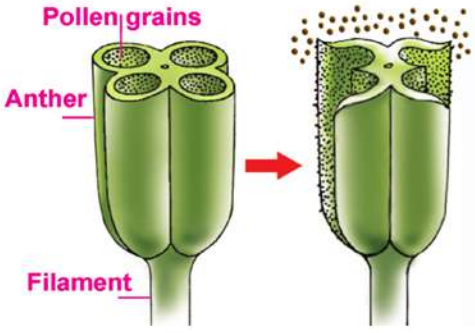
The flower is a short stem where the leaves have been modified to form the genital (reproductive) organs ,which in turn form seeds inside fruits.

- Name the reproductive organ in flowering plants?

Sexual reproduction in plants takes place in two steps; pollination and fertilization.

1 Pollination:

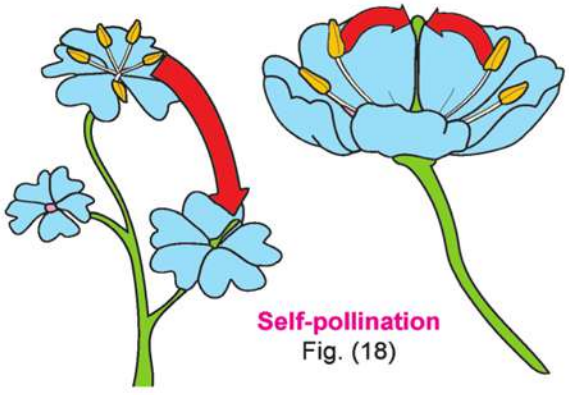
When pollen grains mature and become well developed, the anther splits up longitudinally, releasing pollen grains in the air, Fig. (17). The process of the transfer of pollen grains from anthers of a flower to the stigma is called pollination.



L.S. in the anther
Fig. (17)

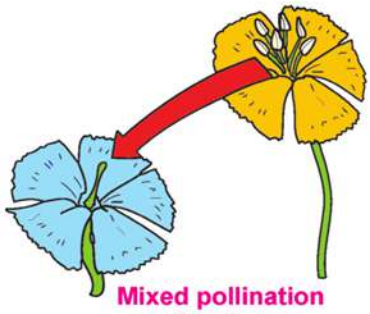
Types of pollination:

When pollen grains transfer from the anther to the stigma in the same flower or in another flower but in the same plant, this is called auto (self) pollination Fig. (18).



Self-pollination
Fig. (18)

- On the other hand when pollen grains transfer from the anther of one flower to the stigma of another one on a different plant, this is called mixed pollination. Fig. (19).



Mixed pollination
Fig. (19)

Exercise (3)

Conclude the type of pollination in each of the following flowers:

1. The flowers of sunflower plant where their anthers and stigmas never grow at the same time. (.....)
2. The flowers of barley plant, which never bloom before being fertilized. (.....)
3. The unisexual flowers of maize. (.....)
4. The flowers of flax plant where their anthers and stigmas grow at the same time. (.....)

The methods of cross pollination:

The pollen grains are transferred from one flower to another by many ways:

1 pollination by air:

Observe Fig. (20) with your classmates.....what do you conclude?
Flowers pollinated by air are characterized by the presence of hanging anthers, easily opened by air and their stigmas are feathery- like and sticky to catch pollen grains. Fig. (20)

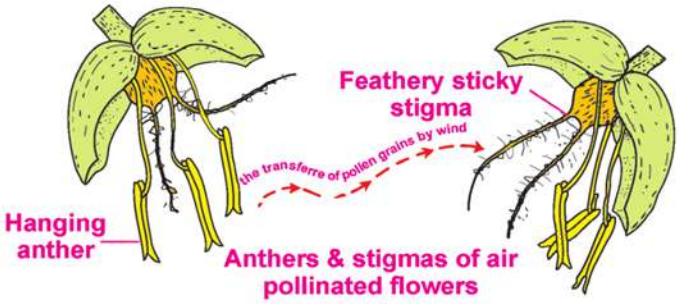


Fig. (20)

Air pollinated flowers produce huge numbers of pollen grains to compensate what are lost in air Fig. (21). The pollen grains of such flowers are light in weight, dry and can be easily carried by air currents.

The transfer of pollen grains by wind
Fig. (21)

Enrichment information (3)

* Maize plant produces about 50 millions pollen grain.
* Search for the flowers which are pollinated by air.

2 Pollination by insects:

Observe Fig. (22) with your classmates.....what do you conclude? The flowers pollinated by insects are characterized by colored, scented petals to attract insects, like bees, to feed on its nectar. The pollen grains of such flowers are characterized by being, sticky or having coarse surfaces to stick to the insect's body. Fig. (22)

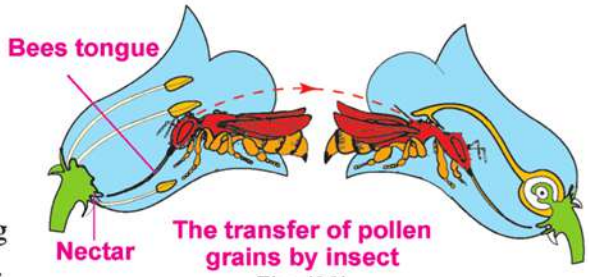


Fig. (22)

3 Artificial pollination:

It means pollination taking place by the help of man; as it occurs when the Gardener spread palm tree's pollen grains over their female flowers.

2 Fertilization:

Fertilization in plants means, the fusion of the male cell (pollen grain) with the (female cell) ovum. How does this happen?

Participate with your classmates in the co-operative group, in performing the following activity:

Activity (3) Pollen grain germination:

Microscope
Fig. (23)

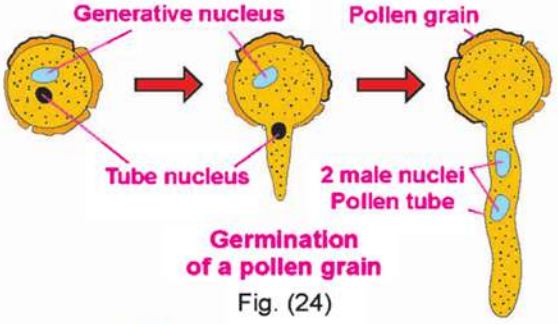
Materials and tools :

- Diluted sugar solution.
- Glass slides and covers.
- Water.
- Microscope.

Steps :

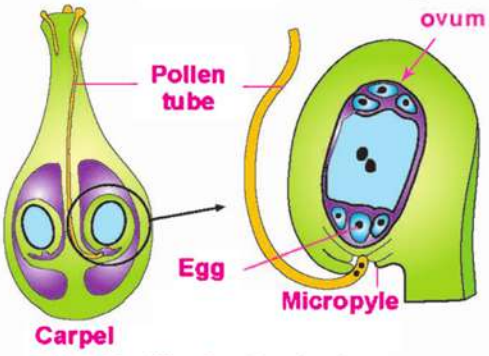
1. Put a drop of the diluted sugar solution onto a glass slide, then add pollen grains, and cover them with a glass cover.
2. Repeat the previous step, replacing diluted sugar solution with water.
3. Put both slides in a dark warm place for half an hour.
4. Examine both slides using the microscope Fig. (23), What do you observe? .....
   - Does the pollen grain show any change after adding the diluted sugar solution drop? .....
   - What is the relation between what you have observed and what happens when the pollen grain falls on the stigma of a flower?.....

- After pollination, the pollen grain stick to the stigma, this secretes a sugary solution. The pollen grain then begins to germinate forming a **pollen tube** containing two male nuclei Fig. (24).



Germination of a pollen grain
Fig. (24)

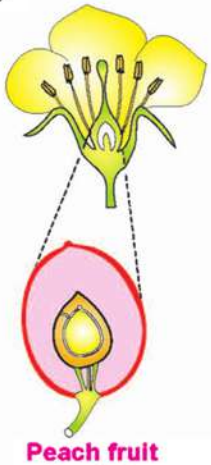
- The pollen tube extends through the style and reaches the ovum by the micropyle opening in the ovary Fig. (25). The tip of the pollen tube degenerates in order that one of the two male nuclei fuses with the egg to form a fertilized ovum which is known as **the zygote**. The zygote in turn undergoes a process of successive divisions to form the embryo inside the ovum, which develops to become a seed at the same time the ovary grows to become the **fruit**.



Fertilization in plants
Fig. (25)

- Fruits differ from each other according to the nature of the ovary, if the ovary contains one ovum; it gives rise to a fruit with a single seed inside it, like olive and peaches. Fig. (26)
- However, an ovary with many ova, gives rise to a fruit with many seeds inside it, like beans and peas. Fig. (27)

Pea fruit
Fig. (27)



Peach fruit
Fig. (26)

Exercise (4)

After fertilization is completed, what happens to the wall of the ovary and the oval membrane?

.....

.....

Second: Asexual reproduction in plants

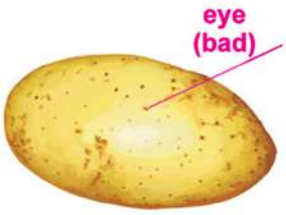
- Can plants reproduce without the presence of flowers?
  Some plants can reproduce without the presence of flowers by means of parts of the roots, stems, leaves or buds, which is known as vegetative reproduction.
  Vegetative reproduction may be natural or artificial.

1 Natural vegetative reproduction:

Plants reproduce by vegetative reproduction in many ways like; reproduction by rhizomes, offshoots, chromes, tubers and bulbs. From which we'll study:

Reproduction by tubers:

- A tuber is a root like sweet potatoes or a underground stem like potatoes Fig. (28).



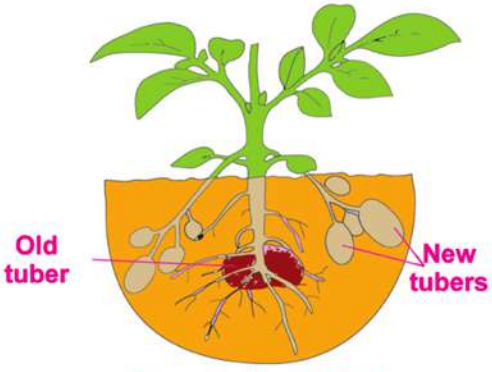
Potato tube
Fig. (28)

Participate with your co-operative group in doing the following activity:

Activity (4) Identify reproduction by tubers

1. Cut a tuber of potato into multiple slices, where each slice should contain a bud or more.
2. Cultivate these parts and water them regularly. What to do observe after one week? …….....……

   Some buds grow forming a root system, and a shoot system, and after a while new tubers grow. Fig. (29)



Reproduction by tubers
Fig. (29)

2 Artificial vegetative reproduction:

1 Reproduction by cutting:

- The cut is a part of a stem , taken from a plant for the purpose of reproduction. It's more common for the cut to be a branch carrying many buds, Fig. (30)

Participate with your classmates in the following activity:

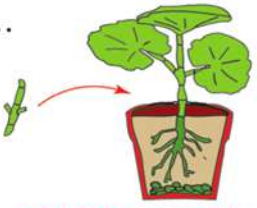
A cut
Fig. (30)

Activity (5) **Identify reproduction by cutting**

1. From the nearest flower house, get cuts of different plants, like grapes, roses, sugar cane, etc.
2. Cultivate them in a pot or a can full of soil, keeping in your mind a bud or more, should appear above soil surface. Water the cut what do you observe after two weeks?

.....

- The buds buried inside the soil, grow to form roots, while the buds above the surface of the soil grow to form the shoot system of the plant. Fig. 31. These shrubs are then transferred to the soil to grow more efficiently.



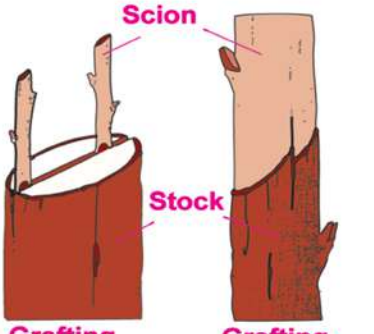
Reproduction by cutting
Fig. (31)

2 Reproduction by grafting:

In reproduction by grafting, an individual plant is selected containing more than one bud, known as scion, to be put on another one known as the stock.

Methods of reproduction by grafting:

- Grafting by attachment: where the scion is attached to the stock, Fig. (32) as it occurs in mango trees.
- Grafting by the wedge: where the scion in the form of a wedge (pencil shaped) is inserted into a cleft in the stock Fig. (33) as it occurs in large trees.



Grafting by wedge
Fig. (33)

Grafting by attachment
Fig. (32)

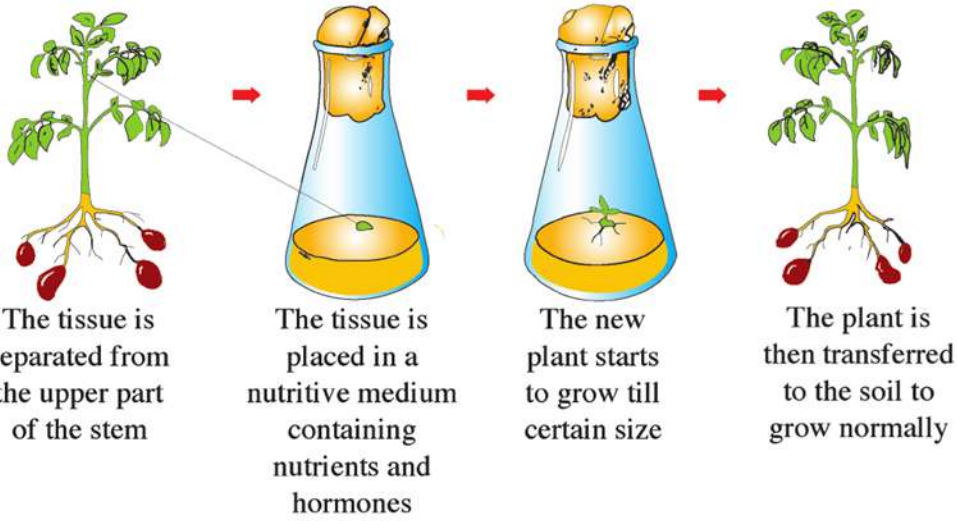
In either cases, the scion and the stock are tied up tightly together, where the insert feeds on the juice of the origin, and the arising fruits belong to the scion. This type of reproduction is only applicable for plants highly similar to each other, like orange and naring, apples and pears, peaches and apricots.

3 Tissue culture:

The scientists have developed a process of multiplying a small part of a plant to get many identical parts. This process is known as tissue culture. Fig. (34)

Enrichment information (4)

Glueing stem is a desease which infect bitter orange trees, which doesn't infect naring. That's why reproduction by grafting is useful when the disease spreads in orange fields. In this case orange is the scion while bitter orange is the stock.



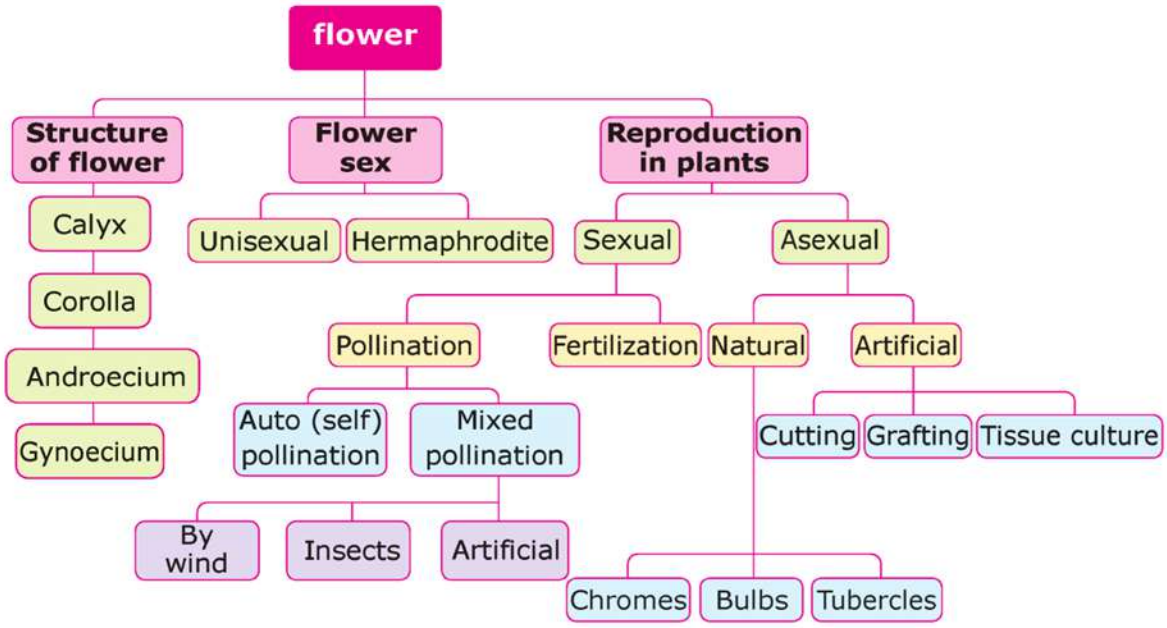
Tissue culture from potato stem
Fig. (34)

Discussion issue **Investment and management of resources and their development**

- Some countries lately started to produce fuel from some crops like wheat. Discuss with your classmates under supervision of your teacher this issue, making the following questions, part of your discussion.

  - Why did they think about wheat to make fuel?
  - Do you prefer using wheat as fuel or just in making bread?
  - If you were a farm owner, would you export wheat for a low price to make flour, or export it in high prices to make fuel?
  - What do you suggest as necessary means of cultivating wheat more widely?

Lesson summary



- Androecium is the male organ in the flower, while gynoecium is the female organ.
- The hermaphrodite (bisexual) flower carries both male and female organ.
- The flower is a short stem, in which the leaves are modified to form reproductive organs.
- After fertilization, the ovary develops to become the fruit, and the ovum to becomes the seed.
- Tissue culture: a new evolved method of using a small tissue part of any plant to get many identical parts to be used or cultivated later.

Lesson One Assessment

1 Write the scientific term for each of the following:

(a) Short stem where the leaves developed and modified into reproductive organs.(.....)

(b) The cell resulting from the fusion of the pollen grain and the ovum nuclei. (.....)

(c) A new method to produce large numbers of plants from a small part of it. (.....)

2 Choose from the column (b) and (c), what's suitable for column (a):

(a)	(b)	(c)
Floral whorl	**Consists of**	**Function**
1. Calyx	1. Stamen	1. Male organ in a flower.
2. Corolla	2. Sepals	2. Female organ in a flower.
3. Androecium	3. Crapels	3. Protects the inner parts of a flower.
4. Gynoecium	4. Petals	4. Attract insects to the colored leaves.

3 Exclude the unsuitable word, then write down the relation between the rest of the words:

(a) Stigma /stamen/style/ovary .....

(b) Cuttings/ pollination/layering / grafting .....

4 What happens to each of the following after fertilization .....?

(a) Ovary .....

(b) Zygote .....

5 Give reasons for each of the following :

(a) Palm flowers are unisexual.

.....

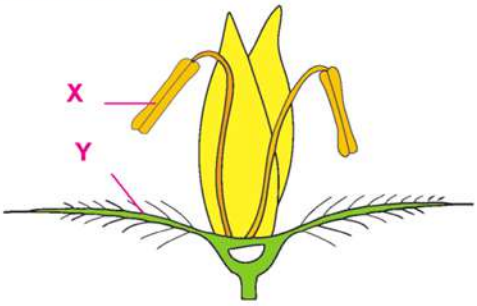
(b) Auto pollination can't happen in sunflowers.

.....

(c) Flowers pollinated by insects produce coarse pollen grains.

.....

6 The opposite figure shows a flower being pollinated by wind (air):



(a) Write the labels for each of x and y.

.....

(b) Mention two characteristics that make this flower pollinated by wind (air).

.....

(c) Explain how cross pollination happens in this flower.

.....

7 Creative thinking:

There are many opinions, whether agreeing or disagreeing with cutting trees in tropical forests. Write as many agreeing or disagreeing opinions as you can.

Activity

Search in the school library or through the internet, on vegetative reproduction by offshoot, layering, and bulb, write an essay about that illustrated by figures.

Lesson 2

Human Reproduction

Lesson objectives:

By the end of studying this lesson, the student should be able to:

1. Recognize the structure of the genital system in human male.
2. Recognize the structure of the genital system in human female.
3. Conclude the function of the genital organs in human male.
4. Conclude the functions of the genital organs in human female.
5. Compare between the functions of female and male genital organs.
6. Describe the structure of the sperm.
7. Describe the structure of the ovum.
8. Conclude the concept of fertilization in humans.
9. Describe the stages of development of the embryo inside the woman's uterus.
10. Recognize some sexually transmitted diseases.
11. Recognize the different ways of preservention against sexually transmitted diseases.
12. Preserve health against the hazards of infection by sexually transmitted diseases.
13. Commit to healthy sexual habits.
14. Commit to the scientific, religious and social ethics.

Elements of the lesson:

1. Male genital system.
2. Female genital system.
3. The concept of fertilization in humans.
4. The structure of the sperm and the ovum.
5. Stages of development of the embryo inside the uterus.
6. Veneral diseases and methods of prevention.

Involved Issues:

1. Sexual culture.
2. Reproductive health.

- The process of reproduction aims to secure the existence and continuity of living organisms' species and to prevent them from extinction. You might be enquiring… why can't man reproduce by asexual methods?
  The offspring coming out through asexual reproduction are identical to the parent. While in humans, each and every individual has to be very special and different from others. That's why humans reproduce sexually – by mating – by means of two different persons – the male and female – using special system called reproductive or genital system.
  The structure of the genital system in male and female differ completely as each has its specific function.

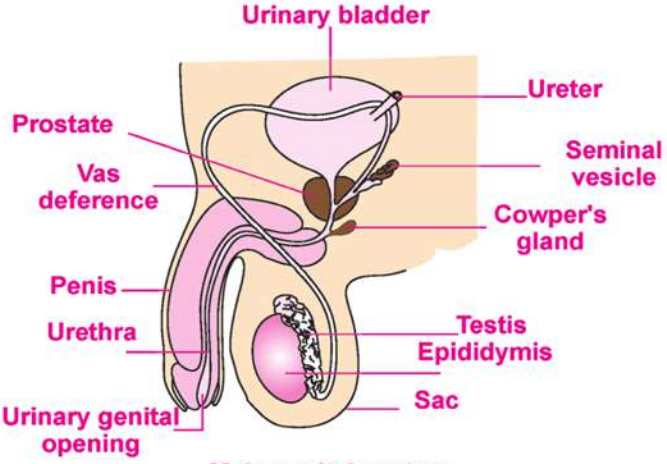
First: Genital system in male:

- Take part with your classmates in the co-operative group under supervision of your teacher in performing the following activity, to be familiar with the structure of the male genital system by using one of the learning aids.

Activity (1) Identify the male genital system

1. Make use of an illustration for the male reproductive system - Fig. (1) Observe and mark the main components.
2. Trace the track of the sperm starting from the testicles.
3. What do you expect to happen to the journey of the sperm, if the vas deferens were cut?

- The human male genital system consists of; the testes, vas deferens, the urethra passing through the penis, in addition to associated glands.



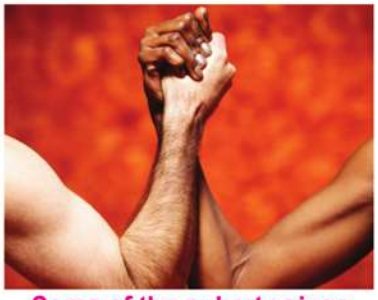
Male genital system
Fig. (1)

1 The testes:

The testes are two glands, elliptical in shape and their function is to produce sperms and the male hormone known as testosterone, responsible for the appearance of secondary sexual characters in males, known as signs of puberty.

What are the male puberty signs shown in Fig. (2)?

……


Some of the puberty sings
Fig. (2)

The signs of puberty in the human male include;

Hair growth in certain areas of the body as well as the moustache and beard, harshness of voice, the growth and development of the genital organs, growth of bones and enlargement of muscles. Fig. (2)

The testes are enclosed inside a sac is known as scrotum outside the body hanging between the thighs. Its function is to regulate and preserve the temperature of the testes two degrees below the normal temperature of the inside f the body, which is the optimum temperature for the growth and development of sperms.

Enrichment information (1)

The testes of the elephant are present inside the body cavity. That's why it is surrounded by some cooling system that preserves the optimum temperature for the testes to function efficiently and produce healthy sperms.

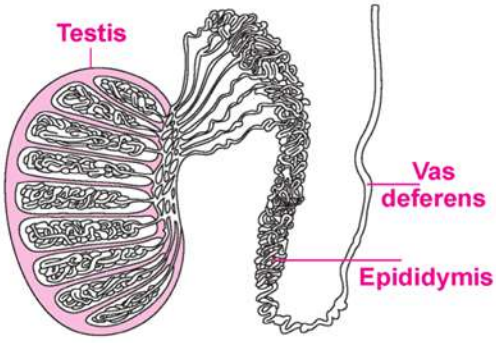
Exercise (1)

What do you expect to happen if the testes where present inside the body and didn't come out during the development of the embryo?

.....

2 Vas deferens :

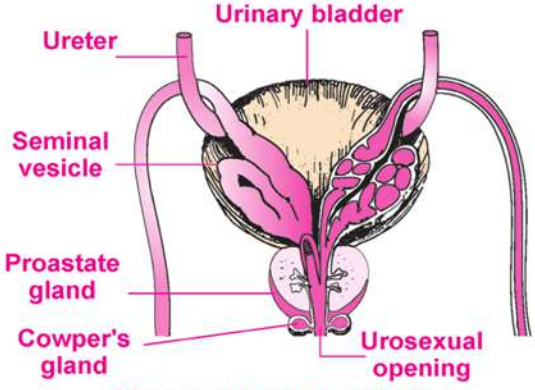
Attached to each testicle is a group of fine highly looped tubes known as the epidedimis, where the sperms continue the final stages of growth and development and storage. The epidedimis continues in the form of a long single tube known as the vas deferens. This tube helps transfer the sperms from the testes to the urethra.



The connection of the vas deference
Fig. (3)

3 The associated glands:

Three kinds of glands are connected to the human male genital system, which are the seminal vesicles, the prostate and Cowper's glands Fig. (4). The secretions of these glands go with the sperms to form an alkaline fluid known as the seminal fluid. This fluid helps in neutralizing the acidity of the urethra, so that the sperms don't die during passing through it. It also contains a lot of nutrients that help nourishing the sperms and keep them alive and facilitates their flow.



The associated gland to the genital system
Fig. (4)

Enrichment information (2)

The prostate is a muscular gland surrounding the urethra at the site of connection with the urinary bladder and it might be enlarged in some men above fourty years. This leads to increasing pressure on the urethra which eventually causes difficulty in urination and needs to be removed surgically.

4 The penis :

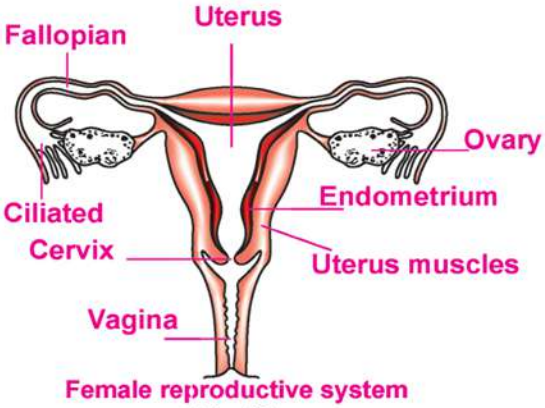
It's an organ composed of a sponge- like tissue, the urethra passes through it and it ends by urosexual opening, through which the semen goes out as well as urine but never at the same time.

Second : The female genital system:

- The genital system in female differs from that in male in many aspects, mostly in being adapted to carry the embryo during the period of pregnancy.
  Take part with your classmates in the co-operative group under supervision of your teacher in performing the following activity to be familiar with the structure of the human female genital tract using some learning aids:

Activity (2) Identify the structure of the female genital system in man

1. Make use of a 3D model or an illustration showing the human female reproductive system. Fig. (5)
2. Observe and trace the track of the ovum starting at the ovaries.
3. What do you expect to happen to the journey of the ovum if the fallopian tubes become obstructed or surgically tied?

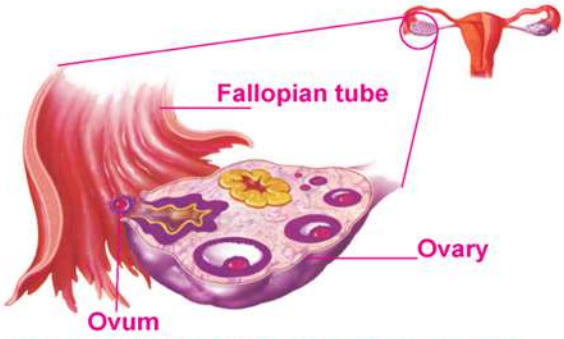


Female reproductive system
Fig. (5)

- The human female genital system consists of two ovaries, fallopian tubes, the uterus and the vagina.

1 The ovaries:

The ovaries are two glands, each one is in the size of a peeled almond like and they lie inside the body in the lower part of the abdominal cavity from the back. The ovaries are responsible for the production of the ova, one ovum every 28 days, produced by each ovary mutually in a process known as ovulation. Fig. (6)
The ovaries are also responsible for the production and secretion of the female hormones, namely;



The production of the ova and ovulation
Fig. (6)

- Estrogen: which is responsible for the appearance of secondary sexual characters in female
- Progesterone: which is necessary for the initiation and continuity of pregnancy.

Signs of puberty in females:

The growth of armpit and pubic hair, softness of voice, growth and development of breasts, fat accumulation in certain parts of the body, start of menstrual cycle which takes part every 28 days as long as no pregnancy happens. Menstrual cycle starts at the age of 11: 14 years of age and stops at the age of menopause 45: 55 years.

Exercise (2)

Calculate the number of ripen ova, that an adult woman can produce during 35 years, and what do you know about menopause?

.....

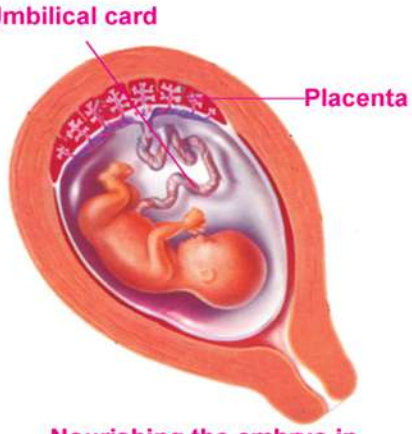
2 fallopian tubes:

Each starts with a funnel shaped opening with finger like processes and ended by joining the uterus at its upper corners. These tubes are adapted to receive the ovum and deliver it to the uterus Fig. (7). This is aided by the contractions and relaxations of the muscles present in the wall of the tubes as well as the movement of the lining cilia.

The motion of ovum in fallopian tube
Fig. (7)

3 The uterus:

The uterus lies in the pelvic cavity between the urinary bladder and the rectum. It's a pear shaped hollow organ, with a muscular wall, that can expand during the stages of fetal growth during pregnancy Fig. (8). The uterus is lined by a mucus membrane rich in blood capillaries to form the placenta responsible for nourishment of the embryo during pregnancy by the umbilical cord.



Nourishing the embryo in the uterus
Fig. (8)

4 The vagina:

The vagina extends from the uterus and ends by the external genital opening. It's a muscular tube that expands during labor to deliver the baby.

Fertilization in humans

Self enquiry:

You might have asked yourself; is fertilization in humans similar to that in plants?

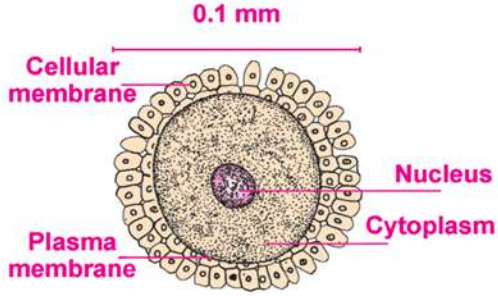
Communication

Discuss with your classmates under supervision of your teacher, what do the human male and female produce which is similar to the ova and pollen grains in plants?

- Before identifying the concept of fertilization in humans, you should firstly be familiar with the structure of the ovum and the sperm.

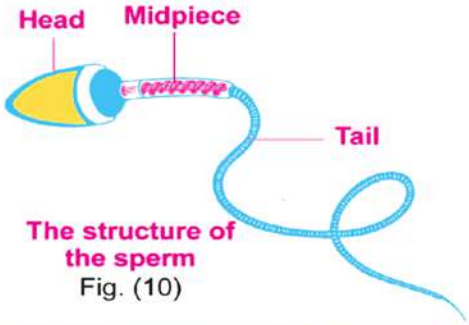
Structure of the ovum:

The ovum is a static spherical cell Fig. (9) it's relatively large in size (the size of a sesame seed) due to storage of nutrient materials.
It is composed of; a nucleus, which contains half of the genetic material for the species (chromosomes), the cytoplasm which stores food and nutrients. The cell is coated from outside by an intact cell membrane.



The structure of the ovum
Fig. (9)

Structure of the sperm :



The structure of the sperm
Fig. (10)

From Fig. (10), can you recognize the main components of the sperm? What are they?

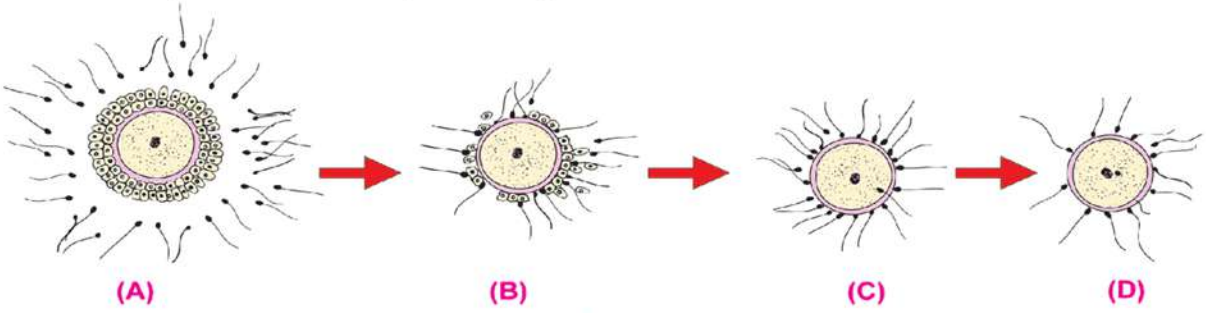
- The sperm is considered very small by compare to the ovum.
- The sperm is composed of the head, containing a nucleus with half of the genetic material (chromosomes), the middle part which contains mitochondria responsible for energy production needed for the movement of the sperm. The tail is thin and long and is responsible for swimming and movement of the sperm to reach the ovum.

Enrichment information (3)

The testes of the adult human male produce about 2 billions sperms per day. The lifetime of a single sperm inside the female vagina ranges from 2 to 6 hours. This period can extend to reach up to 3 days if the sperm managed to break through the cervix and enters the uterus, where it feeds on uterine secretions.

Fertilization and embryo formation :

- You knew that the body of any living organism consists of cells; each cell contains a nucleus that comprises the genetic material of the species. The genetic material, chromosomes, carries genes which are responsible for the hereditary traits of the organism.
  The ovum and sperm differ in structure from any other cell in the body, regarding the number of chromosomes in the nucleus of each, where each of the nucleus of the ovum and the sperm contains only half the genetic material.



Steps of fertilization
Fig. (11)

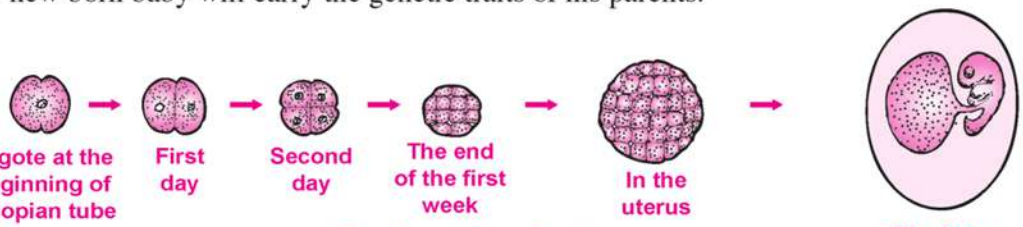
- During mating, the male secretes billions of sperms, the move from the vagina to the uterus and then to fallopian tubes. On the other hand, the female produces only one ovum in the 14th day from the begining of menstruation.

The sperms rush towards the ovum, at the beginning of fallopian tubes,(Fig. 11a). The head of the sperm secretes a material that dissolves the wall of the ovum and facilitates its penetration, (Fig. 11b), (Fig. 11c).
After the process of successful penetration, the ovum encloses itself by a membrane that prevents any other sperm from penetration.
(Fig. 11d).

The nuclei of the sperm and ovum fuse together to form the fertilized ovum known as the zygote that contains a nucleus with 23 pairs of chromosomes. The zygote then transfers to the uterus to be implanted in its wall and start the journey of embryo formation and development, by being divided several times to form a clump of cells that continue to grow and specialized into different types of tissues.

Fertilization process
Fig. (12)

The new born baby will carry the genetic traits of his parents.



The formation of embryo
Fig. (13)

Exercise (3)

Conclude the concept of fertilization in human.

.....

- The duration between fertilization and delivery is known as the pregnancy. This period lasts for 9 months.

Enrichment information and activity (4)

- In case of failure of fertilization, the endometrium falls down and the rich blood capillaries detach causing blood to flow out of the vagina in a process known as the menstruation.
- Search in books and the internet for the menstrual cycle in cats and mice.

Stages of fetal development :

First stage :

- Duration: it starts from the moment of zygote formation till the end of the sixth week.
  The head starts to morph and is similar to the head of reptiles. The eyes can be clearly distinguished.
- The heart of the embryo can be detected using sonar and heart beats can be heard by the end of the sixth week Fig. (14)

The fetus at the 6 th week
Fig. (14)

Second stage:

- It starts from the beginning of the seventh week till the end of the twelfth week.
- Facial features are clearer at this stage. The genital organs start to develop as well as the appearance of digits in the limbs Fig. (15).

The fetus at the 8 th week
Fig. (15)

Third stage :

- It starts from the beginning of the thirteenth week till the end of the twenty second week.
- In this stage, bones start to form and develop as well as the circulatory system. The sex of the embryo can be easily distinguished at this stage. The mother can feel the movement of the embryo as it gained muscles and strength that facilitates movement.

The fetus at the 16 th week
Fig. (16)

Enrichment information and activity (5)

- If the rate of growth of the embryo was the same along the whole period of pregnancy as the rate during the fourth month, the new born will weight quarter a ton!!

Fourth stage:

- It starts from the beginning of the twenty third week till delivery.
  At this stage, all parts and systems of the body of the embryo are completely specialized and well developed. The embryo can move hands and feet. As the time of delivery approaches, the position of the embryo gradually changes to be inverted where the head directed towards the cervics.
  The fetus can be delivered by the twenty eighth week, where the lungs area capable of breathing and all other systems are perfectly working.

Baby during labor
Fig. (17)

Diseases of the genital system :

- Genital system diseases in male and female are classified into two types:
- First type: diseases not arising from sexual contact like; uterine cancer, prostate cancer, puerperal sepsis
- Second type: diseases arising from sexual contact, sexually transmitted diseases STDs, like: gonorrhea, syphilis and AIDS
  In this unit we will only study puerperal sepsis as an example of the first type and syphilis as an example of the second type.

1 Puerperal sepsis :

The bacteria responsible for puerperal sepsis are transferred by droplets from a person infected with bacteria, and suffering severe throat infection or tonsillitis, to a mother who's just given birth to a child, or from an infected wound. The incubation period of the disease ranges from one day to four days, which is the duration between start of infection and appearance of symptoms.

Spherical bacteria
Fig. (18)

Symptoms severe increase in body core temperature, chilling, pallor, severe acute pains in the lower abdomen associated by bad smelling secretions from the uterus.

Enrichment information (6)

The bacteria causing puerperal sepsis can be transferred to the patient by her own throat secretions. That's why a pregnant woman suffering any respiratory disease should be treated first before delivery especially in the last two months to avoid autoinfection. Suggest some ways and preventive methods to prevent puerperal sepsis.

Prevention: is achieved by commitment to good sterilization methods for surgical and personal tools, as well as wearing masks during delivery. Another approach is by preventing visits to the mother after delivery, especially if the visitors were or appeared to be suffering from respiratory diseases. The mother should also be kept warm and avoid exposure to cold air currents.

2 Syphilis :

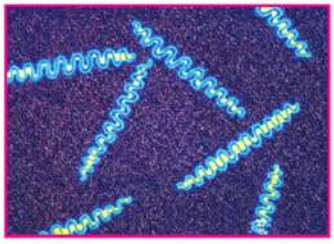
Syphilis is caused by a special type of bacteria, that's transferred either from an infected person by sexual contact. The bacteria can also be transferred from the pregnant woman to her embryo. Fig. (19)

Incubation period two to three weeks

Symptoms:

- The formation of a painless hard ulcer on the head of the penis in males and in the vagina and the upper part of the cervix in females.
- Dark brass colored rash appears on the back and hand of the patients. Fig. (20)

If the patient wasn't treated as soon as the symptoms appear, the patient could develop tumors in different parts of the body like the liver, bones and parts of the genital system. The brain may also be damaged and the patient eventually dies. Syphilis can be treated in all the fore-mentioned stages.



Spiral bacteria
Fig. (19)

The hand of patient of syphilis
Fig. (20)

……..

The effect of Smoking and addiction on the genital system :

1 - Decrease the formation male hormone in man and female hormane in woman.

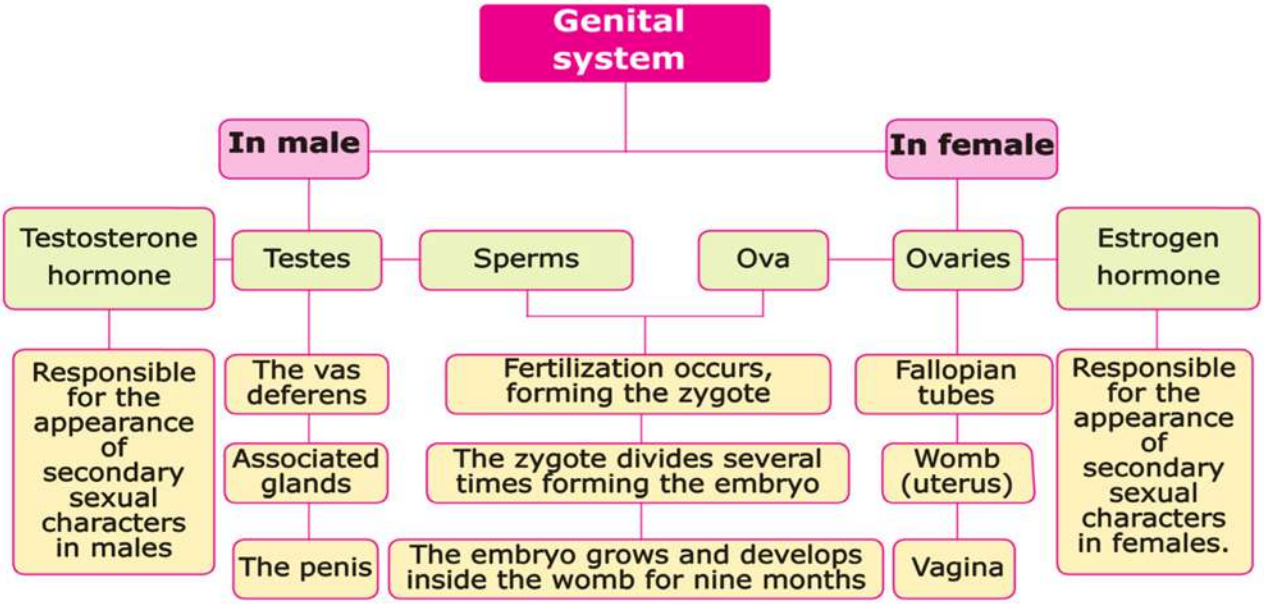
2 - Lead to the death of the embryos and recent born babies.

3 - the intake of drugs by pregnant mother lead to the increase of deformation rate is the embryos.

Real Life Application: Healthy toilet seat cover

A plastic medical cover in the form of an elliptical plastic frame – sold in pharmacies – is to be used in public toilets to avoid infection by some skin and genital diseases.

Lesson summary



- Three glands are associated with male genital system: two seminal vesicles, Cowper's glands, and the prostate.
- The ovum is a static, large sized cell with respect to the sperm.
- Among the diseases of the genital system are puerperal sepsis and syphilis.

Lesson Two Assessment

1 Complete the following statements:

(a) The sperm consists of……, middle part and……

(b) The …….. hormone in males and the …… hormone in females are responsible for the appearance of secondary sexual characters.

(c) ……glands and ……..gland are from the glands associated with the male genital system.

2 Choose the correct answer from those between brackets:

(a) Fertilization occurs when……is formed

(embryo – zygote – endometrium – ovum)

(b) An ulcer appears at the tip of the penis in males ……infection.

(syphilis – gonorrhea – puerperal sepsis – German measles)

(c) The right ovary in the human female, produces a mature ovum every…….. days.

(24 – 28 – 34 – 56)

3 Give reasons for each of the following:

(a) Fallopian tubes ligation is considered a mean of birth control.

(b) The man, whose testicles are still present inside the abdominal cavity, is infertile (sterile).

(c) The baby can be born in the seventh month of pregnancy.

4 Compare between the ovum and the sperm through three points of comparison.

Point of comparison	Ovum	Sperm
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

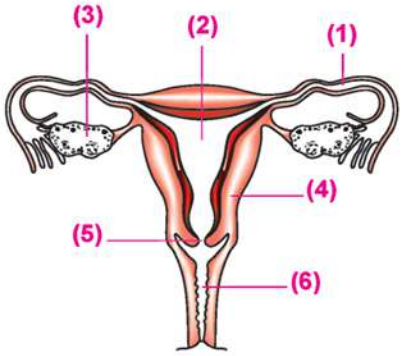
5 Follow the stages of development of the fetus till the third stage.

.....

.....

.....

6 Study the following figure which represents the female genital system, then answer the following questions:



(a) Replace the numbers present on the figure by the suitable labels.

(b) What's the organ in which;

(i) Ova are produced.

(ii) The ovum is fertilized.

(iii) The embryo is delivered to life.

7 Mention the symptoms of syphilis and the preventive methods.

.....

.....

8 Creative thinking:

Write down as far as you know about the methods of prevention against diseases of the genital tract.

.....

.....

Activity

Write down, in no more than one page, an issue discussing artificial fertilization after referring to the school library or by searching the web.

Unit three Assessment

1 Write the scientific term for each of the following

(1) An oval shaped gland that produces male cells. (.....)

(2) Flowers Contain male and female organs together. (.....)

(3) The process of producing ova from the ovaries mutually every 28 days. (.....)

(4) The reproduction of some plants by parts of the roots, stem or leaves. (.....)

2 Correct the following sentences without changing the underlined words:

(1) The wall of the ovary after pollination forms the wall of the fruit.

.....

(2) The progesterone enzyme is responsible for pregnancy to take place and continue.

.....

(3) Reproduction by tuber happens in orange and bitter orange.

.....

(4) The ovum is a mobile cell, of a relatively large size.

.....

3 Extract the unsuitable word, the write the relation between the rest of the words:

(1) sepals/petals/tubers/crapels.

.....

(2) AIDS/ gonorrhea/ syphilis/ measles.

.....

4 Give reasons for each of the following:

(1) Man can't reproduce asexually.

.....

(2) The petals of corolla are colorful and scented.

.....

5 What's meant by each of the following?

(1) The sperm carries half of the genetic material of the species.

.....

(2) Tissue culture of a plant root.

.....

6 Study the opposite figure, which represents the male genital system, then answer the following:

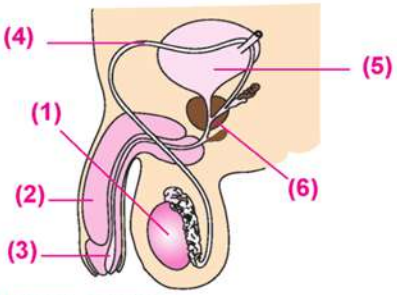
(1) Replace the numbers with the suitable labels.

(2) Write the number of the part, in which:

(a) Sperms are produced.

(b) Secretion of semen

(c) Transfer sperms from the testes to the penis.



7 Draw an illustration showing the structure of the female human ovum.

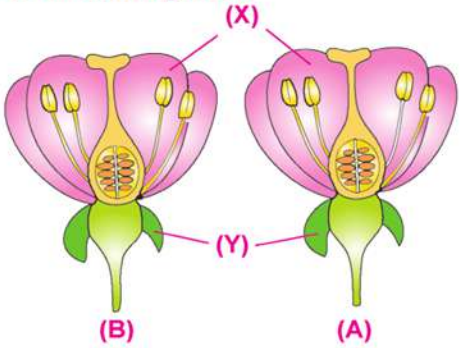
8 The opposite figure shows two flowers of two plants of the same species:

(1) What's the function of the parts x and y?

(2) Pollen grains from the flower (a) are transferred to the ova in flower (b):

(a) What's the type of pollination that happened?

(b) What's the sex of flower (a)?



Reflection and Self evaluation

Dear student, after finishing with studying the third unit; reproduction and continuity of species, record your opinion and points of view by answering the following questions:

(1) What issues were useful to you after studying the unit?

.....

(2) What negative images did you have about some concepts or phenomena that were corrected during the study of the unit?

.....

(3) What difficulties did you face during study or performing activities?

.....

(4) What parts do you prefer to revise and reconsider till you fully understand it?

.....

(5) What issues do you suggest for study and were not included in the unit?

.....

General Exercises (1)

1 Write the scientific term for each of the following:

(1) A disturbance that propagates and transfers energy along the direction of propagation. (.....)

(2) The return (recoil) of a light ray when it is incident in a medium of larger optical density by an angle larger than critical angle for this medium. (.....)

(3) The tones acompanying the fundamental tone are higher in pitch and less in intensity. (.....)

(4) Two glands that produce the female cells in human females. (.....)

2 Complete the following statements:

(1) A complete oscillation comprises……..successive displacements, each one is called……

(2) Sound intensity at a certain point is……proportional to the square of the distance between this point and the sound source, and is……. proportional with the square of the amplitude.

(3) When you look at a coin in a glass of water, it's…….position appears to be lower than the …….position.

(4) Hermaphrodite flowers take the symbol……,while male flowers take the symbol…….

3 Mention one function or importance for each of the following:

(1) sonar set ……

(2) Savart's wheel ……

(3) The mid piece of a sperm ……

(4) Optical fibers ……

4 What happens in the following cases?

(1) The decrease in the frequency and velocity of propagation of a wave to quarter its value with respect to the wavelength.

……

(2) If the time separating the original sounds produced and its echo was less than 0.1 seconds.

……

(3) The distance between a light source and a surface was doubled with respect to light intensity.

……

(4) A pollen grain falls on the stigma of a flower.

.....

5 Give reasons for each of the following:

(1) Sound can be heard from all surrounding directions.

.....

(2) The difference in frequency between the musical note and noise.

.....

(3) The absolute refractive index for any transparent medium is larger than 1.

.....

(4) A new mother should avoid air currents after delivery.

.....

6 Using an illustration for the path of light rays, show the concepts of critical angle and total internal reflection.

General exercises (2)

1 Give reason for:

(1) The periodic time decreases as the number of complete oscillation increases.

(2) The sound of thunder is heard after the seeing of lightening.

(3) The sound intensity decreases gradually as the amplitude of its source decrases.

(4) It is preferred to install mercury bulbs in car's headlights?

(5) It is preferred to print books and reference books on unshining papers.

2 Put (√) or (x):

(1) The light ray refracts towards the normal,when it travels from air to glass.

(2) The fish is seen higher than its real position in the fish tank.

(3) The corolla consists of bright colored scented leaves.

(4) Auto (self) pollination accurs in barely plant.

(5) The human female's ovule is a settled sphere shaped cell.

(6) The semen's nucleus contais half the number of chromosomes.

(7) The mother feels the movement of the embryo from the start of the 13th week.

(8) The particles of the medium vibrate along the direction of the wave propagation in the longitudinal waves.

(9) The sound intensity decreases, when it touches an empty box.

3 Mention the scientific meaning of the following terms:

(1) Complete oscillation. (2) The wave motion

(3) Sound frequency. (4) Sound reflection. (5) Genes

4 Complete the following statements:

(1) The velocity of the oscillating body is maximum, when it passes through .....

(2) When the tuning fork oscillates, ... is generated which travels in the form of sound waves.

(3) Sound pitch is a property by which the ear can distinguish between.....and ..... voices

(4) A flower arises from a flowering bud, usually emerging from axils of the leaf known as .....

(5) In the reproductive system of the human male,each testis is attached to highly looped tubes known as.....

General exercises (3)

1 Choose the correct answer for each of the following:

(1) The time taken by the vibrating body to make one complete oscillation is.....

a- amplitude. b- frequency.

c- periodic time. d- complete oscillation.

(2) The number of complete oscillation made by the oscillating body in one second is .....

a- amplitude. b- frequency.

c- periodic time. d- complete oscillation.

(3) The maximum displaceement made by the oscillating body away from its original position is .....

a- amplitude. b- frequency.

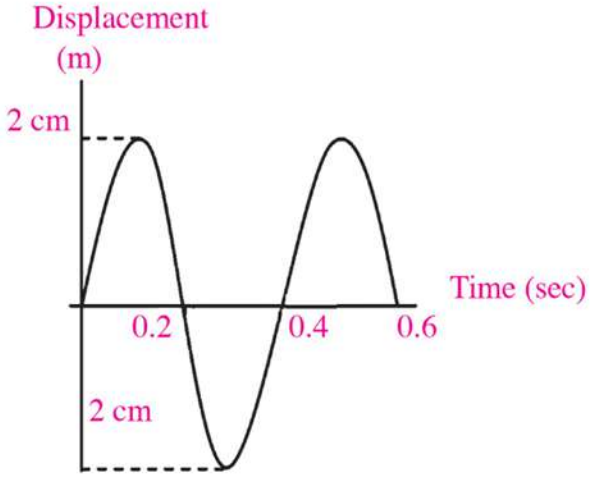
c- periodic time. d- complete oscillatin.

(4) From the figure below , choose the correct answer from between the brackets:

a- The periodic time = (0.2 s - 0.4 s - 0.6 s - 0.4 m)

b- The frequency = (0.2s - 0.4Hz - 2.5Hz - 0.4m)

c- The amplitude = (0.2s - 0.4s - 3 cm - 0.4 cm)



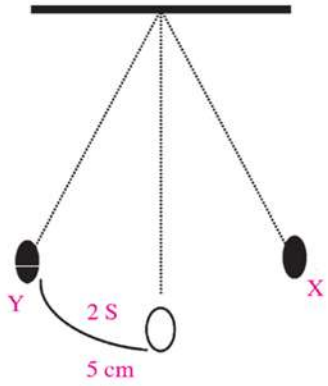
(5) From the opposite figure, choose the right answer from between the brackets:

a- The periodic time = (2 s - 8 s - 6 s - 3 cm - 5 cm)

b- The frequency = (0.2 s - 0.4 Hz - 1/8 Hz - 0.4m)

c- Amplitude = (0.2 s - 0.4 Hz - 3 cm - 5 cm)

d- The distance covered in a complete oscillation = (0.2s - 0.4Hz - 20 cm - 5 cm)



(6) The mathematical relation between velocity and wave length is .....

a- Velocity = frequency x wave length.

b- Velocity = wave length / frequency .

c- Wave length = frequency / Velocity

d- no correct answer.

(7) The transverse wave consists of :

a- Compressions and rarefactions.

b- Crests and troughs.

c- Crests and compressions.

d- Rarefactions and troughs.

(8) The longitudinal wave consists of :

a - Compressions and rarefactions.

b - Crests and troughs.

c - Crests and compressions.

d - Rarefactions and troughs.

(9) A girl stands watching water waves, she saw 4 waves passing in 2 seconds the wave length for each is 0.5 m so , ...

A - The wave frequency = ...

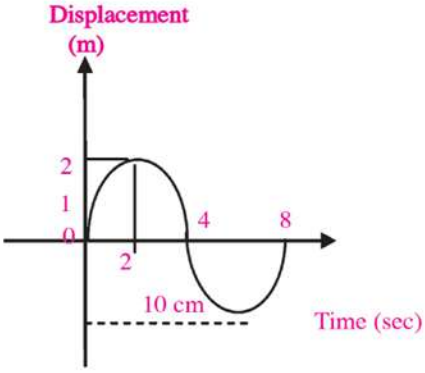
a - 2 Hz b - 4 Hz c - 4 m/sec d - 0.25 m/sec

B - The wave velocithy = ...

a - 1 m/sec b - 0.2 m/sec c - 4 m/sec d - 0.25 m/sec

(10) The opposite fig. represents :

(The displacement in meters - time in seconds) from the drawing:



1 - The amplitude = ...

a - 2 cm b - 3 cm

c - 4 m d - 8 cm

2 - The periodic time = ...

a - 1 /8 Hz b - 0.25 Hz

c - 4 sec d - 8 sec

3 - The frequency = ...

a - 1 /8 Hz b - 0.25 Hz

c - 4 sec d - 8 cm

4 - The wave length = ...

a - 1 /8 Hz b - 0.25 Hz c - 4 cm d - 10 cm

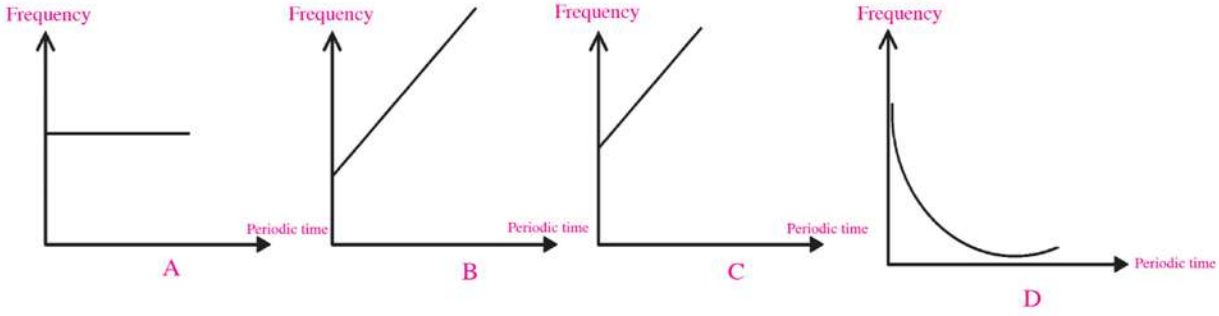
5 - The wave length in meters = ...

a - 1 /8 Hz b - 0.25 Hz c - 1 m d - 0.1 m

6 - Wave velocity

a - 1 m/sec b - 0.2 m/sec c- 4 m/sec d - 0.025 m/sec

(11) Which graph from the following graphs represents the relation between frequency and periodic time?



(12) The sound produced from the school's bell is considered ..... waves

(transverse - longitudinal - electromagnetic)

(13) The repetition of hearing the sound as a result of its reflection is called ..... of sound.

(reflection - refraction - echo)

(14) The depth of seas is estimated by using .....waves.

(ultrasonic - lnfrasonic - sonic)

(15) When the reflection angle is 30. that means that the angle of incidence ray is:

(90° - 30° - 80°)

(16) When the sound travels 300 m in one second, so the minimum distance for the echo to happen is: .....

(5m - 17m - 30m)

(17) The doctors use waves which have a frequency ..... ,to break down kidney and ureter's stones

(less than 20 Hz - 20Hz - more than 20kHz)

(18) The amplitude equals ..... of a complete oscillation.

(quarter - half - four times)

(19) The unit of measuring sound intensity is .....

(m/sec - watt/m2 - decibel)

(20) The bats depend on the phenomenon ..... of sound in hunting its preys.

(reflection - refraction - echo)

(21) The light travels in ..... lines.

(straight - curved - circular)

(22) The incdence angle of light is ..... its reflectioin angle.

(larger than - smaller than - equals to)

(23) The absoulute refractive index of any material is always .....

(mor than one - less than one - equals one)

(24) From the natural phenomena resulting from the total internal reflection of light is .....

(echo - mirage - seeing objects higher than its normal position)

(25)The absolute refractive index is the ratio between speed of light in air and.....

(the speed of light in another medium - the speed of light in the same medium - the speed of sound in the same medium)

(26)The critical angel lies in the medium .....

(with the more optical dense - with the less optical dense - with the same optical dense)

(27) When the light ray travels from the more optically dense medium to the less optically dense medium, so it refracts.....the normal.

(towards - away from - on itself)

(28) The pen seems broken, when it is put in a glass of water as of .....

(light reflection - light refraction - total internal reflection of light)

(29) The distance that light travels in a second is.....

(light frequency - light speed - light intensity)

(30) The device used in submarines to see the bodies outside them on water surfaces is called.....

(soner - hydrophone - periscope)

(31) The light consists of..... colours of spectrum.

(nine - six - seven)

(32) The photon energy = plank's constant x.....

(photon frequency - photon velocity - light intensity)

(33) The bodies that permit the passage of light are called .....

(opaque bodies - transparent bodies - translucent bodies)

(34) The angle between the refracted light ray and the normal at the point of incidence on the separating surface is .....

(the angle of reflection - the angle of refraction - the angle of incidence)

(35) Which one from the following doesn't permit the passage of light through it.

(air - clear water - glass _ mik)

(36) The organ responsible for formation the ova in the flower is the .....

(ovary - anther - corolla)

(37)The male reproductive organ in the flower is .....

(gynoecium - androecium - corolla)

(38) Floral whorl which is not found in the female flower is.....

(calyx - androecium - corolla)

(39) Floral whorl which isn't found in the male flower is.....

(gynoecium - androecium - calyx)

(40) The fusion of the male cell nucleus (pollen grain) with the female cell nucleus (egg) in another flower to form a zygote called .....

(auto pollination - mixed pollination - fertilization)

(41) The egg contains.....of the genetic material of the plant species .

(half - all - quarter)

(42) The zygote contains.....of the genetic material of the plant species .

(half - all - quarter)

(43) The bisexual flower contains.....

(only androecium - only gynoecium - androecium and gynoecium together)

2 Complete the following sentences:

(1) There are two types of periodic motion which are, ……..

(2) The amplitude is ……..

(3) The periodic time is the time ……..

(4) The frequency is …….. in one second.

(5) The amplitude measuring unit is ……..

(6) The frequency measuring unit is ……..

(7) The periodic time measuring unit is ……..

(8) When a body completes 600 complete cycles per minute, the frequency will be = ……..

(9) The Hertz is the measuring unit of ……..

(10) Frequency = ……../periodic time

(11) The longitudinal wave consists of ……..and ……..

(12) The transverse wave consists of ……..and ……..

(13) The mechanical wave are classified into ……..and ……..

(14) ……..and ……..are example of periodic motion.

(15) The simple harmonic motion is an example of ……..motion.

(16) In the ……..waves, the particles of the medium oscillate perpendicular to the direction of propagation.

(17) In the ……..waves, the particles of the medium oscillate a long the direction of propagation.

(18) The maximum displacement made by the oscillating body is called ……..

(19) The wave length of the transverse wave is the distance between ……..

(20) The wave length of the longitudinal wave is the distance between ……..

(21) The crest in the transverse wave corresponds to …… in the longitudinal wave, while the trough corresponds to …….

(22) The sound originates from……bodies.

(23) The sound is considered from the ……waves, because it needs a medium.

(24) The complete oscillation includes ……displacements each of them is called……

(25) The human ear could hear the sounds that its frequency ranges between…and…hertz.

(26) From the factors that affects the sound intensity are ……,……and……

(27) The sound intensity is……proportional with square of the distance between the source and this point and this relation is called…… .

(28) As the amplitude increases, the sound intensity……

(29) The sound pitch is …… ,while its intensity is …… .

(30) The sound frequency is measured in a unit called……,while the sound intensity is measured in ……

(31) The frequency of sonic waves is between ……and ……Hz, while the frequency of ultrasonic waves is ……Hz and also the frequency of infrasonic waves is ……Hz.

(32) The first law of sound reflection states that……..

(33) The second law of sound reflection states that.....

(34) For an echo to be heard, the distance between the ear and the sound source must be = ……meters.

(35) The light consist of……..colours.

(36) The first law of light reflection states that……...=.....

(37) The light is a ……..wave that propagates in vacuum.

(38) When a light ray falls perpendicula on a reflecting surface, the angle of reflection will be=...

(39) The photon energy =……..x……..

(40) The transparent medium……..while the opaque one……..

(41) The sound intensity is known as……..

(42) The inverse square law states that……..

(43) The pirescope is used in……..

(44) From the natural phenomena that are related to the reflection and refraction of light are……..., ……..and……..

(45)The absolute refractive index is the ratio of……..to……..

(46) The light intensity is the amount of light……..

(47) The light intensity of a surface is……proportional with square of the distance between the surface and the light source.

(48) The light velocity is the distance……..

(49) The optical fibers are used in……..

(50) The…..of a surface is inversely proportional with square of the distance between the surface and the light source.

(51) ……..is considered as the male reproductive organ in the flower.

(52) ……..is considered as the female reproductive organ in the flower.

(53) The components of the flower are protected by leaflets called……

(54) Fertilization is the process of fusing the male cell nucleus (pollen grain)with a …… nucleus to from……

(55) The bisexual flower contains……and……,but the male flower contains……only.

(56) From the artificial vegetative reproduction in plants are ……, …… and ……

(57) The meaning of pollination……process is……,while the meaning of fertilization process is……

(58) The floral leaves of calyx have.....colour and each one is called.....

(59) The corolla works on.....

(60) Sweet potato is considered as.....,while the potatoes are.....and reproduction in both of them is done by.....

(61) Tissue culture is from the ways of natural vegetative reproduction.

(62) .....is considered from the ways of natural vegetative reproduction.

(63) .....and.....are from the diseases that are related to the reproductive system.

(64) The testis function is to produce.....and secrete the.....hormone.

(65) The human male reproductive system consists of.....and.....

(66) The human female reproductive system consists of.....and.....

(67) ....., ... and are from the features that indicate puberty in males.

(68) The associated glands with male gental system are....., ... and.....

(69) The infection with syphilis and.....is caused by.....

(70) ....., ... and are from the features that indicate puberty in females.

(71) Each testis in the human male is attached with a number of highly looped tubes known as.....

(72) ....., ... and .....are from the symptoms of syphilis.

(73) The vas deference transports.....from.....to.....

(74) The sperm consists of ....., ... and.....

(75) The zygote of human carries.....chromosome.

3 Write the scientific term for each of following:

(1) Sound waves used in detecting industrial defects.

(2) The bouncing of rays to the same medium upon meeting on a reflecting surface.

(3) Sound waves produced by bats and received by them when meeting an abstacle.

(4) The angle between the incident ray path and the normal at the incidentce point on the reflecting surface.

(5) The angle between the reflected ray and the normal at the incidence point on the reflecting surface.

(6)Sound waves have a frequency less than 20 Hz.

(7) A property by which the ear can distinguish sounds from the view of their source even if they were equal in the intensity and pitch.

(8)A property by which the ear can distinguish between harsh and sharp voices.

(9) Conversion of sound at a point due to its reflection on a concave surface.

(10) The angle of incidence=the angle of reflection.

(11) The incident ray and the reflected ray and the normal from the point of incidence on the reflecting surface all lie in the same plane perpendicular on the reflecting surface.

(12) The first one to prove the energy of the photon depends on its frequency.

(13) The distance covered by light in one second.

(14) The changing of light ray path when moving from a transparent medium to another transparent medium.

(15) The ratio of the light velocity in air to its velocity in any other medium.

(16) An incidence angle in the denser medium that causes a refraction angle equal to 90° in the less dense medium.

(17) The angle between the incident light ray and the normal at the point of incidence.

(18) The angle between the incident light ray and the normal at the point of incidence on the separating suface.

(19) A device used in submarines to see the bodies outside it on water surface.

(20) A phenomenon that appears in the dessert as a result for total internal reflection.

(21) The angle between the reflected light ray and the normal at the point of incidence on the reflecting surface.

(22) A device used in the analysis of light.

(23) The light intensity is inversely proportional to square of the distance between the point and light source.

(24) Bodies allow the passage of light through them.

(25) Bodies don't allow the passage of light through them.

(26) Bodies allow the passage of a part of the light through them and absorb the rest part.

(27) The amount of light falling perpendicularly on a unit area from a surface in one second.

(28) A physical quantity equal the multiplication of plank's constant X frequency.

(29) A group of coloured leaflets surrounding the flower.

(30) A floral whorl in the flower, its function to attract insects, because of it is colorful and scented.

(31)A floral whorl in the flower, its function to protect the inner parts of the flower.

(32) A group of colored leaflets each of them is called petal.

(33) A group of green leaflets each of them is called sepal.

(34)The fusion of the male nucleus (pollen grain) with the nucleus of an oval.

(35) A flower that contains androecium only.

(36) A flower that contaions gynoecium only.

(37) A flower that contains androecium and gynoecium.

(38) The male reproductive organ in the flower.

(39) The female reproductive organ in the flower.

(40) The transferring of pollen grain from the anthers of a flower to the stigma of another flower.

(41) The resulting cell of the fusion of the pollen grain nucleus with the egg nucleus.

(42) The embryo is formed, fed and protected in it until its birth.

(43) A tube with a funned shaped opening transports the ovum to the uterus.

(44) A hormone produced by the testis.

(45) A disease, its symptoms appear as a rash on the reproductive organ.

(46) Group of glands , their function secrete is to semen.

4 Put a right (√) or wrong (X) in front of the following sentences :

(1) The amplitude is the covered distance in a complete oscillation. ( )

(2) The frequency is the number of complete oscillations produced by the oscillating body. ( )

(3) The amplitude is measured in meter. ( )

(4) The tuning fork oscillation is an example for the periodic motion. ( )

(5) The amplitude is the maximum displacement made by the oscillating body. ( )

(6) The swing is an example for the periodic motion. ( )

(7) The simple pendulum is an example for the periodic motion. ( )

(8) The velocity of the oscillating body is maximum ,when passing at original position. ( )

(9) The periodic time is the time taken by the oscillating body to make one complete oscillation. ( )

(10) The frequency is the reciprocal of the periodic time. ( )

(11) The wave length for a transverse wave is the distance between two successive crest and trough. ( )

(12) The frequency is the number of complete oscillations that are made by the oscillating body in one second. ( )

(13) The wave length for a transverse wave is the distance between the first crest and the second crest. ( )

Essay question and problem solving:

1 Give reasons for the following:

(1) The echo is used to determine the depth of the seas.

(2) The bats fly in the dark without colliding any obstacles.

(3) The human's ear can distinguish between the violin sound and the piano sound.

(4) The echo doesn't occur in the classroom.

(5) In mosques the ceilings are built in the shape of domes.

(6) The hearing sense of the fink fox is so strong.

(7) Dolphins don't hit water obstacles during swimming.

(8) The floor of the swimming pool appears higher than its original position.

(9) The absolute refractive index for any substance is more than 1.

(10) The ray falling perpendicular on the reflecting surface reflects on itself.

(11) The occuring of mirage in the dessert.

(12) The ray falling perpendicular on the separating surface between two media different in the optical density doesn't refract.

2 What is meant by the following

(1) The oscillating body makes 30 oscillations in one second.

(2) The oscillating body makes 240 oscillations in half a minute.

(3) The oscillating body makes 540 oscillations in a minute and a half.

(4) The oscillating body covers a distance of 20 cm in one complete oscillations.

(5) The maximum amplitude made by the oscillating body = 60m.

(6) The time taken by the oscillating body to make 30 complete oscillations in 10 seconds.

(7) The periodic motion made by the osciallating body around its original point and repeats the motion in equal time intervals.

(8) The motion made by the oscillating body when it passes by a point in its path two successive times in the same direction.

(9) Sound reflection.

(10) Sound intensity.

(11) Sound pitch.

(12) Sound quality.

(13) Decibel.

(14) First law of reflection.

(15) Second law of reflection.

(16) Sonic waves.

(17) Ultrasonic waves.

(18) Infrasonic waves.

(19) Echo.

(20) Angle of incidence.

(21) Angle of reflection.

(22) Refraction of light.

(23) Total internal reflection.

(24) Critical angle.

(25) Absolute refractive index.

(26) The inverse square law of light.

(27) The mirage phenomenon.

(28) Pirescope.

(29)Regular reflection.

(30) Non-regular reflection of light.

(31) Transparent medium.

(32) Transcelucent medium.

(33) Opaque meduim.

(34) Optical fibers.

(35) Optical density.

3 What is the difference between each of the following.....?

(1) Syphilis disease and puerperal sepsis.(from the point of view of symptoms)

(2) The oval and the sperm of human.

4 Problems:

(1)A ship made a sound in water then its echo was heard after 2 seconds if you know that the velocity of these waves in water is 1000 m/sec calculate the depth of the water.

(2) A person made a sound near a mountain then heard its echo after 3 seconds if the velocity of sound in the air near the mountain is 340 m/sec calculate the distance between the mountain and the person.

(3)Calculate the frequency of a musical tone similar to the tone produced from a savart's wheel rotating with a velocity of 960 revolution in 2 minutes, knowing that the number of gear teeth = 30.

(4) Sound waves have frequency 400 Hz in air and its wave length is 85 cm, calculate the velocity of these waves.

5 Write the physical relation between each of:

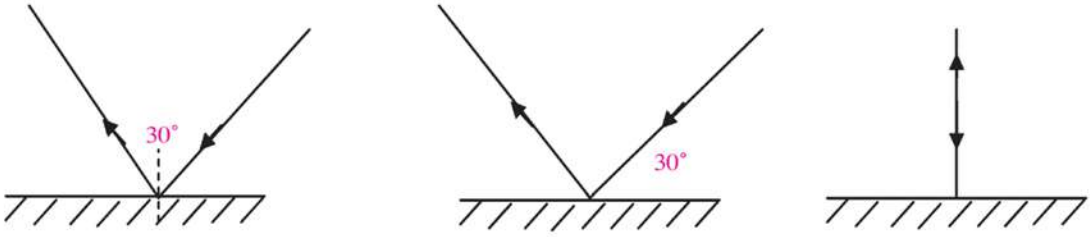
(1) The energy of the light wave and the wave frequency.

(2) The wave velocity in meduim and the reflective index for its material.

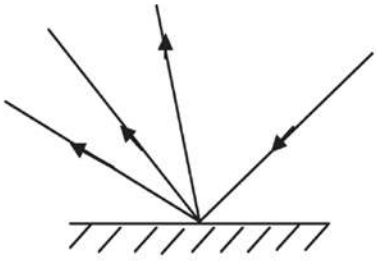
(3)The angle of incidence and the angle of reflection of light.

6 Question on figures:

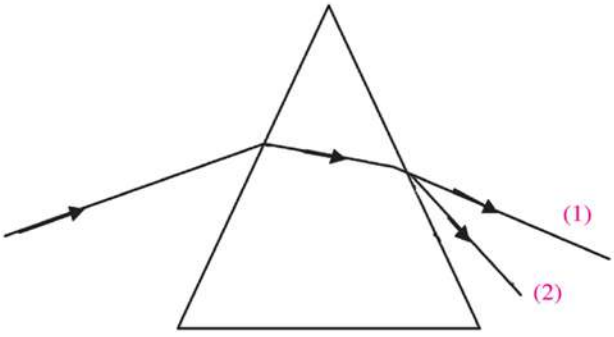
(1) Find the values of the angle of incidence and the angle of reflection in each of the following cases:



(2)Which from the following reflected rays represents the reflected ray in the right direction, and why?



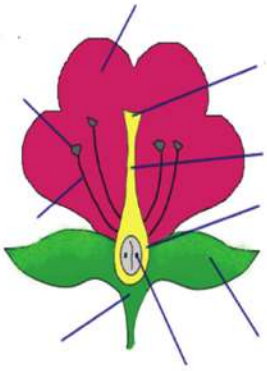
(3) In the following figure which represents the red color and which represents the violet?



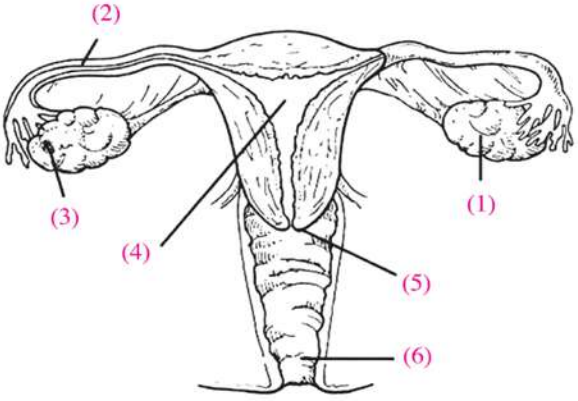
(4) Write the labels on the opposite figure, and answer the following:

a Mention the sex of the flower in the drawing.

b What kind of pollination that happens in this flower?



(5) Complete the lables on the drawing and mention its name.



(6) Illustrate each of the following by drawing only :

(1) Female flower.

(2) Male flower.

Second Term Exams

Exam (1)

1 Write the scientific term for each of the following:

(1) A disturbance that causes the oscillation of the medium particles.

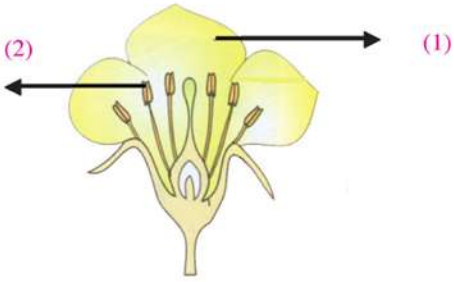
(2) The usage of a piece of a plant stem for reproduction.

(3) The maximum displacement made by the oscillating body away from its original position.

(4) The distance covered by light in one second.

(5) The time interval from the beginning of the infection till the appearance of the symptoms.

2 Complete from the opposite fig:



(1) Points to.....

(2) Points to.....

3 Choose the right answer:

(1) The sound intensity is measured in .....

a- Hertz. b-Watt/m.

c- decible. d-m/sec.

(2) All the following methods are examples for the artificial vegetative reproduction.

a- Cutting b- bulbs

c- grafting d- tissue culture.

(3) The distance between two successive troughs or two successive crests in the transverse wave is.....

a- Wave length. b- amplitude.

c-frequency. d- wave velocity.

(4) The sound waves are.....waves.

a-longitudinal b- transverse

c- electromagnetic d-no right answer.

(5) The partial immersed pencil in water looks broken because of light.....

a-reflection. b- refraction.

c- deviation. d-total reflection.

4 Give reasons for the following:

(1) The ceilings of worship houses are built in the form of domes.

(2) The wood doesn't allow the passage of light through it.

(3) The sex of the embryo is unknowable before the 7th week of pregnancy.

5 Put(√) or (X).

(1) The sound quality is the property by which the ear can distinguish between strong sounds and weak sounds.

(2) The syphilis is transferred from the infected person through the sexual contact.

(3) The crest is the highest point in the transverse wave.

(4) The transverse wave is a disturbance that causes the oscillation of meduim particals.

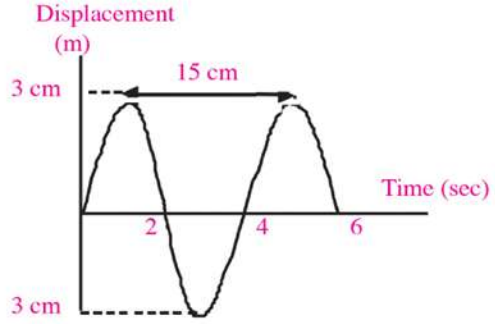
(5) The hereditary substance that carries the genes which is responsible for the hereditary trait, living in organisms.

(6) The corolla is the male reproductive organ in the flower

6 From the opposite fig.

(1) Define the amplitude and find its value from the figure.

(2) Define the wave length in this case and find its value.



7 What is meant by the following.....?

(1) The light intensity.

(2) The vegetative reproduction.

(3) Mixed pollination in plants.

8 Compare between the sperm and ovum by drawing only.

Exam (2)

1 Complete the following sentences:

(1) The sound velocity is measured in .....while the sound intensity is measured in .....

(2) The light reflection is classified in two types which are, ... and .....

(3) The human zygote results from the fusion of ..... and ..... and contains ..... chromosomes.

(4) From the factors affecting the sound intensity are ..... and .....

(5) The savart's wheel is used in determining ....., while the barometer is used in .....

2 Choose the right answer:

(1) The frequency of the oscillating body is measured in a unit called .....

a- Hertz. b-Watt/m.

c-decible. d-m/sec.

(2) If the angle between the incident ray and the normal at the point of incidence on the reflecting surface = 50°,so the angle of reflection = ...

a- 40^{0}. b-50^{0}.

c-130^{0}. d-60^{0}.

(3) The artificial vegetative reproduction is done in plants by .....

a- cutting b-grafting

c- tissue culture d-all the previous

3 Mention the sex in each flower from the following:

(1) (2) (3)

4 Put(√) or (X).

(1)The echo is the repeatation of the sound because of its refraction. ( )

(2) The wave is a disturbance causing the oscillation of the meduim particles. ( )

(3)The wave velocity is constant in the same meduim and differs from one meduim to the other. ( )

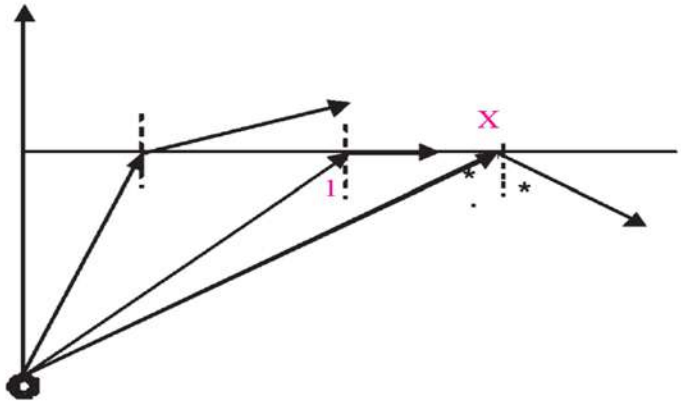
(4) The ceilings of worship houses are built in the form of domes to concentrate the sound. ( )

(5) Chromosomes (the genetic material) carries genes which are responsible for the hereditary traits of the organisms. ( )

5 From the illustrated fig. answer the following:

(1)Mention the name of angle (1).

(2) Mention the phenomenon at point (X).



6 Write the scientific term for each of the following:

(1)The angle between the reflected ray and the normal at the incidence point.

(2) A cell which its nucleus contains 23 pairs of chromosomes resulting from the fusion of sperm and the ovum.

(3) The maximum displacement made by the oscillating body away from its original point.

(4) The distance covered by light in one second.

7 Give reasons for the following:

(1)The light is considered an electromagnetic wave.

(2) The usage of ultrasonic waves to sterilize food.

(3) Dolphins don't collide sea obstacles during swimming.

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(9) BIOLOGY (The unity and Diversity of life) - Wads Worth

مقاس الكتاب	طبع المتن	طبع الغلاف	ورق المتن	ورق الغلاف	عدد الصفحات بالغلاف
١/٨ (٥٧×٨٢)سم	٤ لـــون	٤ لـــون	٨٠ جم أبيض	٢٠٠ جم كوشيه	١٤٠ صفحة